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FLA MAPPING

DELIVERABLE 2.6

TOWARDS A FULLY-FLEDGED FLA MAPPING SYSTEM

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Deliverable 2.6 of the EFP Mapping Work Package (WP2)

ABOUT THE EUROPEAN FORESIGHT PLATFORM (EFP)

The EC under its Seventh Framework Programme for Research and Technology Development (FP7) is providing the means to continue the important networking activities of foresight initiatives. The Coordination and Support Action “EFP European Foresight Platform – supporting forward looking decision making” aims at consolidating the information and knowledge base on foresight in Europe and internationally. The ultimate purpose of EFP is to better exploit foresight as a resource to support policy-making. The knowledge hub has been used in a series of national and European policy workshops, geared towards major future challenges to Europe. For more information about EFP please visit <http://www.foresight-platform.eu>.

ABOUT THE EFP CONSORTIUM

The EFP Consortium consists of four partners: Austrian Institute of Technology (AIT), Institute for Prospective Technological Studies (IPTs), Netherlands Organisation for Applied Scientific Research (TNO) and Manchester Institute of Innovation Research (MIoIR) of the Manchester Business School (MBS) at The University of Manchester.

ABOUT THE EFP MAPPING WORK PACKAGE (WP2)

The EFP Mapping Work Package (WP2) is aimed to monitor, analyse and position (MAP) forward-looking activities (FLA) in Europe and the world. WP2 results can be found in a fully independent Mapping Environment available online at <http://www.mappingforesight.eu>. This is a dynamic web space where visitors can access and share knowledge on forward-looking research and innovation initiatives associated to one or more of the following future-oriented approaches: *foresight, horizon scanning, forecasting and impact assessment*. EFP WP2 leader and the Mapping Team at The University of Manchester will continue developing the Mapping Environment beyond EFP.

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European Foresight Platform
The EC provided the means to continue the important networking activities of foresight initiatives.

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TOWARDS A FULLY-FLEDGED FLA MAPPING SYSTEM

This publication highlights key rationales, tools and results of the first systematic and comprehensive effort to map practices, players and outcomes related to four types of forward looking activities (FLA): foresight, horizon scanning, impact assessment and forecasting.

FUTURES THINKING APPLIED



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FOREWORD

The European Foresight Platform (EFP) is the continuation and extension of the very successful EFMN (European Foresight Monitoring Network) mapping exercise. While EFMN mapped over 2000 foresight cases, EFP extended this approach in two ways. On the one hand, it explicitly included more types of forward-looking activities (FLA). While EFMN focused on mapping work described as *foresight*, EFP also deliberately covered *forecasting* and *horizon scanning* studies, as well as different forms of technology and *impact assessment*. (Some of this work have been inadvertently captured by the EFMN database, but was difficult to differentiate.) On the other hand, EFP mapped many more dimension of foresight activities. In the past EFMN focused on foresight practices and players, EFP has also systematically provide information about the outcomes of forward-looking activities.

To this end this **FLA Mapping** publication outlines a methodology to map forward-looking activities. The “SMART Futures Jigsaw” is a striking visual representation of the more than thirty dimensions used to map FLA. A wealth of data has been provided. The ultimate goal of the mapping is to develop evidence-based analyses of the contours of FLA work, and how they are changing, based on these data.

This sort of work is not just of academic interest: it should also be of value for FLA practitioners and decision makers who commission studies and use their results. The former will benefit from the mapping pointing to what has and has not been attempted in the field, and what results and impacts have been obtained. Thus redundancy can be avoided, and fruitful avenues for further exploration suggested; benchmarks and guides to good practice can be established. Moreover, they will be able to use the web-based mapping environment – available at www.mappingforesight.eu for linking up with other experts and for collaborating with stakeholders on their projects.

Policymakers and other decision makers who are interested in the contents of FLA should be able to benefit from mapping in several ways. The mapping can provide a basis for scoping, interpreting and evaluating FLA. Moreover, it can be used to improve FLA research agendas, as the mapping of the activities will allow for analyses of “hot” topics, emerging issues and potential areas where further research and cooperation may be needed. Most obviously, perhaps, the outcomes of numerous FLA studies are now accessible through a single entry point; decision makers and their advisors can readily locate and consult them for their own missions. As the first systematic library of FLA worldwide, EFP Mapping provides a unique platform for the information, analysis and exploitation of **players**, **practices** and **outcomes** of FLA.

Professor Ian Miles

Manchester Institute of Innovation Research



ABOUT EFP MAPPING RESULTS

The EFP Mapping Results (WP2 deliverables) represent a major step forward in the successful implementation of the SMART Futures approach: A fully-fledged futures mapping framework described in detail and piloted in the theoretical and methodological **1st EFP Mapping Report** (2011).

The **2nd** and **3rd EFP Mapping Reports** (2012) show the implementation of the framework in the *Security* and *Health* sectors, respectively. On the one hand, the EFP Mapping Reports, collectively, put in evidence that the breadth and depth of the EFP mapping activities are substantially bigger in scope than our previous mapping efforts in the European Foresight Monitoring Network (EFMN). Three specific mapping strategies demonstrate this: first, the mapping of a wider range of forward-looking activities (FLA), such as foresight, horizon scanning, forecasting and impact assessment, for example; second, the use of 33 elements in 3 complementary types of mapping including *practices*, *players* and *outcomes*; and third, the use of 50 case studies to cover FLA on *Security* and *Health*, among other sectors. On the other hand, the reports highlight the future potential of larger scale and targeted mapping of FLA outcomes. Of course, it is important to continue mapping practices – to improve the way we conduct and evaluate FLA; and players – to identify key stakeholders, institutions and individuals with whom to establish possible collaborations and to potentially develop a map of players actively shaping our images of the future.

The 2nd and 3rd EFP Mapping Reports on *Security Futures* and *Health Futures* should be read bearing in mind that they are part of a “bigger picture”. Since 2004 the foresight team of the University Manchester has been improving the methodology to map FLA. The “SMART Futures Jigsaw” framework (see Figure 4) used in EFP WP2 has been instrumental to support the generation of a substantial amount of data about 16 Security and 20 Health FLA. Furthermore, we have developed a bottom-up strategy that allows the FLA community to map additional cases using a web-based crowdsourcing approach. This is why the mapping work uses a fully independent system (available online at www.mappingforesight.eu), which has been carefully aligned to the needs of the EFP Mapping Environment, and that of other FLA at international and national levels. Another important consideration of the “bigger picture” of WP2 results is that they are inherently linked to the strategic information needs of a wide range of stakeholders including government, business, research and education actors at local, national and international levels.

This **FLA Mapping** publication highlights key results of the EFP Mapping work (WP2).

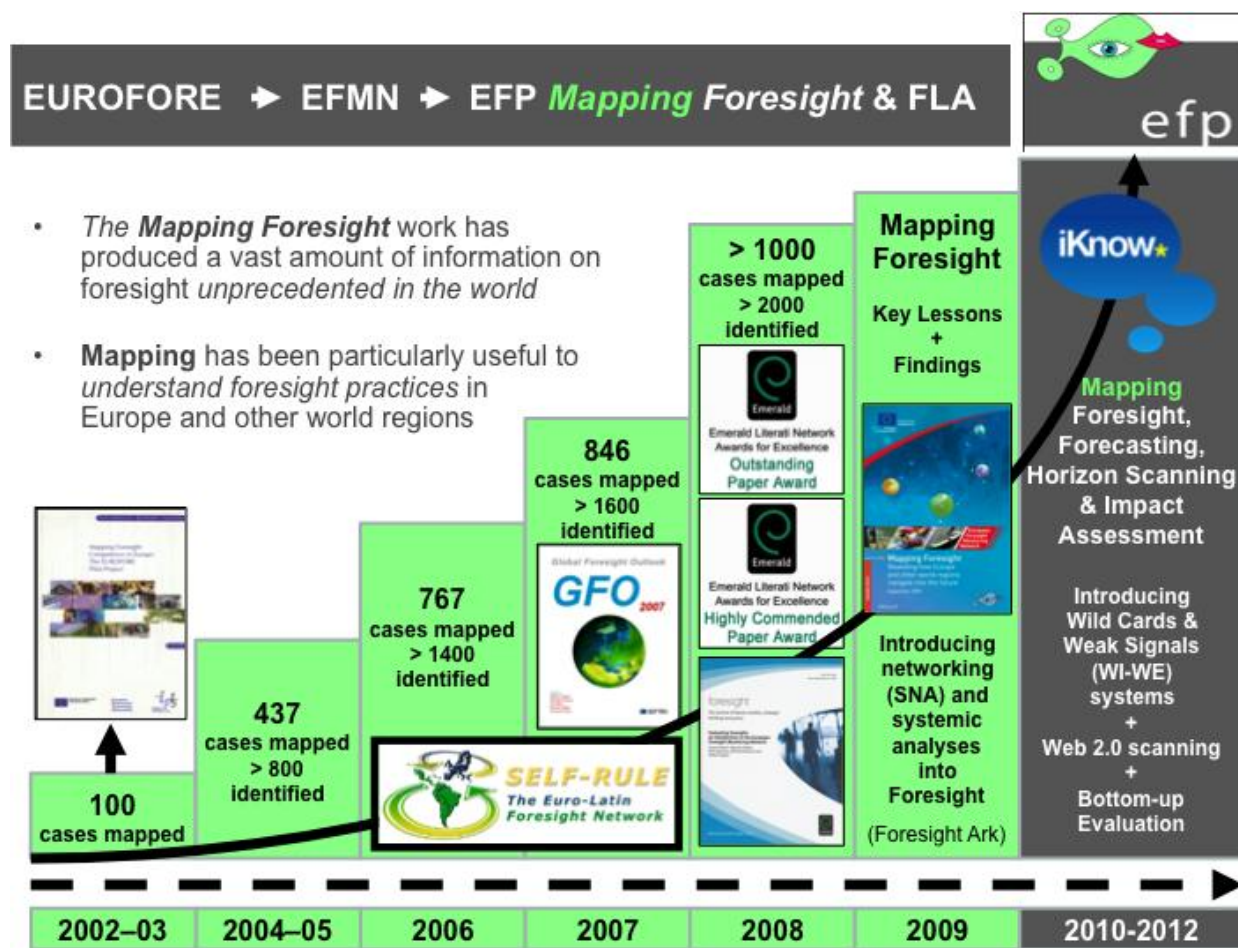
Dr Rafael Popper

Manchester Institute of Innovation Research – EFP Mapping Leader

INTRODUCTION TO FLA MAPPING

For over a decade the European Commission has systematically supported the **mapping** work in an effort to monitor, analyse and position (MAP) *foresight* activities in Europe and the world (see Figure 1). The first of such activities was the *EUROFORE Project* which ran between 2002–03 and analysed some 100 “foresight studies” in the *Mapping Foresight Competence in Europe: The EUROFORE Pilot Project* report.¹ This pilot was instrumental for the elaboration of basic templates and indicators to better understand foresight *practices*.

Figure 1: The Evolution of the Mapping Activities



Drawing on EUROFORE lessons the EC funded the European Foresight Monitoring Network (EFMN) between 2004–08. Several publications were produced based on the analyses of the EFMN Mapping, which reached over 2,000 “foresight studies”.²

¹ The EUROFORE Project. See Keenan *et al.* (2003).

² The EFMN Project. See Popper *et al.* (2005, 2007); Keenan *et al.* (2006); Popper (2008a,b); Keenan & Popper (2008); Popper (2009).

As highlighted in the Foreword to the 2009 Mapping Foresight report:

What is particularly encouraging about the present moment is that we are simultaneously seeing the major steps in foresight mapping that this report embodies – and the move away from self-promoting accounts of how one or other expert conducted foresight, towards better-explicated “warts and all” accounts of actual cases of foresight practice ... practitioners will be able to draw upon various resources accumulated in recent years, to demonstrate the scope for applying foresight and the tools and practices that have been employed successfully in recent exercises. The mapping work of EFMN will certainly be one of the main resources that will be used.

Against this background, the European Foresight Platform (EFP) broadened the scope of its **mapping** activities in order to study main practices, players and outcomes of selected *foresight, forecasting, horizon scanning* and *impact assessment* studies. The following extracts from the 1st EFP Mapping Report offer some common definitions for the four types of FLA considered by EFP Mapping.

Foresight is a systematic, participatory, prospective and policy-oriented process which, with the support of environmental/horizon scanning approaches, is aimed to actively engage key stakeholders into a wide range of activities anticipating, recommending and transforming (ART) technological, economic, environmental, political, social and ethical (TEEPSE) futures.

Horizon Scanning (HS) is a structured and continuous activity aimed to monitor, analyse and position (MAP) “frontier issues” that are relevant for policy, research and strategic agendas. The types of issues mapped by HS activities include new/emerging: trends, policies, practices, stakeholders, services/products, technologies, behaviours/attitudes, “surprises” (i.e. wild cards) and “seeds of change” (i.e. weak signals).

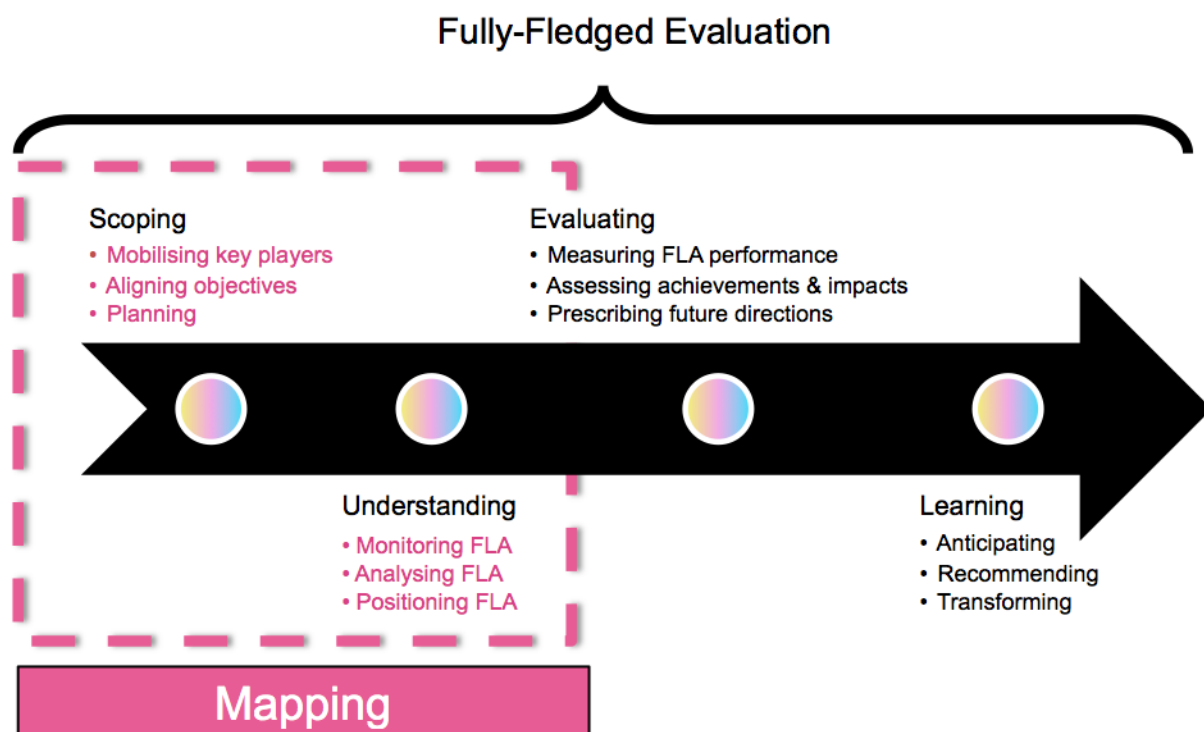
Forecasting is an activity aimed to predict how the future will look like. Such predictions are normally based on two types of knowledge sources: judgemental and statistical. While the former aims to predict one’s own behaviour as well as others’ behaviour; the latter is divided into two branches: univariate (extrapolation models) and multivariate (including theory-based and data-based models) (Adapted from Armstrong, 2001).

Impact Assessment identifies and examines the short- and long-term TEEPSE (technological, economic, environmental, political social and ethical) consequences of an intervention, be it a policy, project, legislation or the application of a technology (EC, 2009; International Association for Impact Assessment, 2011).

The concept of **mapping** and **evaluation** are intimately linked (see Figure 2). In fact, EFP Mapping is conceived as a process which involves (1) *scoping* – i.e. *mobilising* key players, *aligning* objectives to the needs of key players, and *planning* its implementation; (2) *understanding* – i.e. monitoring, analysing and positioning (MAP) forward-looking activities (FLA); and (3) *evaluating* – i.e. measuring FLA performance, assessing FLA effectiveness and impacts; and prescribing future directions.

Furthermore, EFP Mapping is in harmony with the Fully-Fledged Evaluation framework of FLA. By Fully-Fledged Evaluation we mean the “*systematic process aimed at assessing the appropriateness and level of achievement of FLA objectives, performance, efficiency of organisational structure and effectiveness of implementation and aftercare. The process should assess the level of capacities and FLA culture achieved; its national, sub-national and international reach; level of commitment of participants; and novelty and impact of its internal activities. In addition, with the aim of aligning FLA with the implementation environment, the evaluation should try to measure the impact on public and private policies and strategies; agendas of science, technology and innovation (STI) programmes and institutions; consolidation of research groups; consolidation of S&T capacities; and internationalisation of R&D. Finally, a fully-fledged evaluation of FLA should also identify new products and services; new policy recommendations and research agendas; new processes and skills; new paradigms and visions; and new players*” (See *Evaluating Foresight*, 2010).

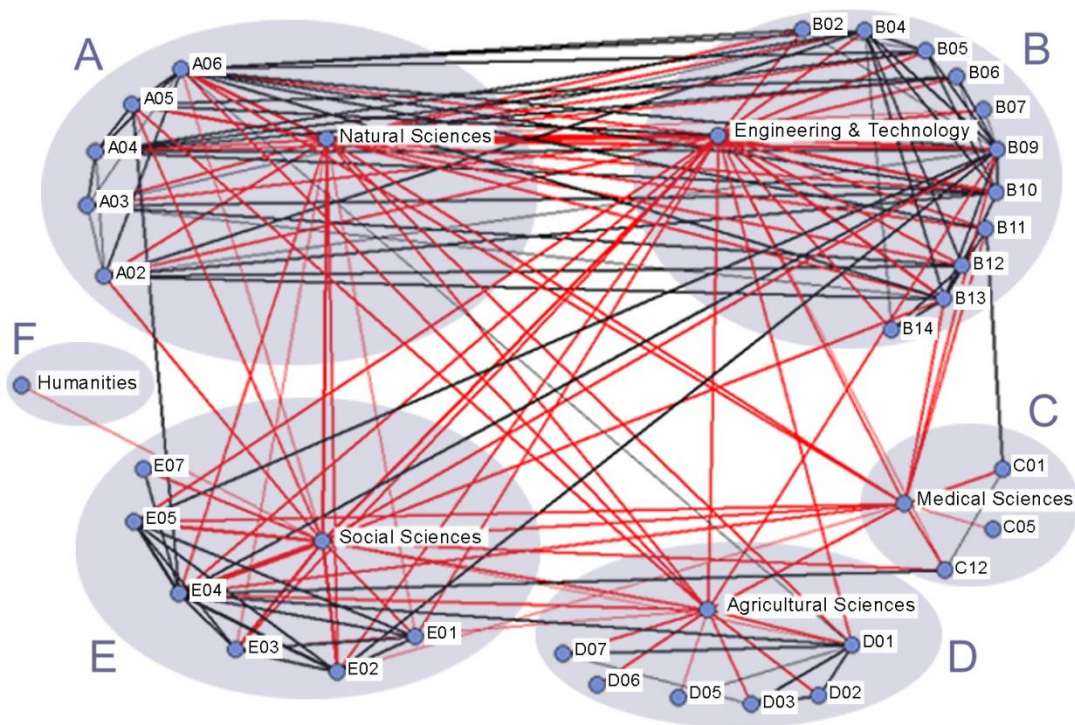
Figure 2: Synergies between Mapping and Evaluation



RATIONALES FOR MAPPING FLA

Over the past years, a growing need for FLA has been recognised in Europe and worldwide, as expressed in the increasing number of FLA interconnecting knowledge from a broad variety of domains (EC, 2010, 2011 – see also Figure 3). At European policy level, a range of new policy initiatives that require a clearer vision of the future as well as enhanced cooperation between different policy areas and policy levels has reinforced the need for FLA. Apart from dedicated FLA (e.g. EFP, iKnow, INFU, FARHORIZON, PASHMINA, CIVISTI, among others), forward-looking elements have been integrated in several European policy instruments, such as the ERA-Nets, Joint Programming Initiatives (JPIs) and Technology Platforms (e.g. in the form of technology roadmaps), and as diverse policy areas as agricultural and energy policy have embarked upon initiatives to better coordinate future sectoral policy needs and research agendas, at national and European level.

Figure 3: Mapping Research Areas Linkages in Foresight



Source: Popper, 2009

Similarly, a growing number of European countries and regions have embarked on FLA to inform and support political decision-making in relation to research and innovation policies. But not only in the public sector has FLA started to play a more prominent role. Corporate FLA, building among others on the tradition in scenario planning, has grown in importance. In the face of the growing richness and diversity of FLA in Europe and

the world, access to information on existing exercises and mutual learning about the experiences made are key to increasing the efficiency of FLA. Previous mapping reports showed the vitality of the FLA, with around 1,000 mapped in detail. The descriptive data have been used to support a range of quantitative analyses, which go beyond simple counts and bar charts of what topics are being addressed, where, and for whom. Figure 3 (above) is a striking visual representation of the application of such analytic methods. The EFP Mapping Environment more dynamic tools that can let us examine the contours of FLA, and how they are changing, in evidence-based ways, from a variety of perspectives – see <http://www.mappingforesight.eu/analysis/>.

Following previous experiences, the EFP mapping approach has been modified and updated in order to take account the key lessons (see 1st EFP Mapping Report). Furthermore, the mapping indicators have been structured in a more refined way and used to design a dedicated EFP Mapping Environment aimed to make mapping results accessible to the wider FLA community through various web-interfaces.

Apart from serving as source material informing and supporting national and pan-European policy processes, EFP Mapping pays particular attention to the analysis of FLA practices, players and outcomes. However, in order to make sure that the mapping work is aligned to the needs of policy shapers, we have conducted three interviews to European Commission officials and asked them: (1) why is the EC interested in the mapping of FLA practices, players and outcomes? And (2) how can policy shapers use such information? The results of these interviews and our own views are summarised in the following three sections on rationales.

RATIONALES FOR MAPPING FLA PRACTICES

In addition to the already valuable repository of knowledge on FLA, the mapping of practices helps policy shapers and other FLA users to put exercises in context (i.e. understanding the background conditions and *raison-d'être* of individual projects). The study of different types of practices also shows the flexibility of FLA and allows us to understand the various activities or building blocks of mapped initiatives. The mapping of FLA practices can also contribute to the identification of similarities and differences between sectoral (e.g. a particular industry), territorial (e.g. regional, national, etc.) and structural (e.g. institutional) studies. Moreover, the mapping of practices can help to answer questions such as: What are the main aims and objectives of FLA? What are the main background conditions (e.g. events, documents) of FLA? What are the most common methodological frameworks in FLA? Etc. Another important rationale for mapping practices is the identification of the role of science and technology issues in different socio-economic and policy areas. This information is normally gathered from the mapping of the domain coverage of an exercise, which maps FLA against thematic priority areas of the EC as well as the FRASCATI and NACE taxonomies.

RATIONALES FOR MAPPING FLA PLAYERS

One of the main reasons for mapping FLA players is to promote networking and cooperation between existing FLA communities. This should in principle empower the 300+ members of the EFP Community and the 2000 members of the iKnow Community by allowing them to identify FLA players in their countries and around the world. Furthermore, a comprehensive “inventory” of FLA players can also be used to identify experienced and emerging practitioners; invite thematic and regional experts to workshops, events, conferences or expert groups/panels. Thus, the mapping of players can be used by various EC departments known as Directorates-General (DGs), including DG Research and Innovation (RTD); DG Agriculture and Rural Development (AGRI); DG Energy (ENER); DG Enterprise and Industry (ENTR); DG Environment (ENV); DG Health and Consumers (SANCO); DG Information Society and Media (INFSO); DG Maritime Affairs and Fisheries (MARE); DG Mobility and Transport (MOVE); DG Regional Policy (REGIO); and – because of the mapping of corporate FLA – DG Competition (COMP), among others. One of the obvious future uses of the results of the mapping for FLA players is to identify partners for research project and methodology experts to support the *scoping* and *mobilising* phases of FLA.

RATIONALES FOR MAPPING FLA OUTCOMES

Similarly to the mapping of practices, the mapping of FLA outcomes is important to build a more structured repository of knowledge about the future. In particular, EC officials have emphasised that this type of mapping is fundamental to access key information providing strategic intelligence for different policy areas and levels. Through the mapping of outcomes FLA can also demonstrate its value for money. However, as our interviews with EC officials have confirmed, the mapping of outcomes is not an easy task. *EFP Mappers* will need to go through selected exercises and dig out immediate outputs (e.g. policy options) as well as other possible outcomes (e.g. new capacities and skills).

There are different levels of sophistication in the mapping of FLA outcomes and results will depend on whether we are mapping ongoing or completed studies, and the timing of completion is another factor influencing the mapping work. For example, the mapping of recommendations will require careful documentary analysis supported with stakeholder interviews. The key challenge here is to achieve an interactive mapping process using “bottom-up” approaches. In fact, EC funded FLA may require: interviewing key members of RTD teams; interviewing EC Project Officers (POs) and EC Head of Units (HUs); and organising face-to-face or web-based activities for FLA users, including POs and HUs, to (possibly anonymously) assess the national and European relevance of FLA outcomes. On this issue, the interviewee from the Joint Research Centre (JRC) showed particular interest in the first level of FLA outcomes, that is, *anticipating* futures. In other words, the mapping of visions, scenarios and forecasts; key technologies;



TEEPSE drivers, trends and megatrends; SWOT and grand challenges; wild cards and weak signals; pathways and roadmaps; and models and frameworks. The second and third levels of FLA outcomes – namely *recommending* and *transforming* futures should be of interest for all EC departments or DGs with an explicit mandate to develop policy.

The mapping of FLA outcomes is complementary to any efforts aimed to evaluate the impacts of RTD projects. Thus, several EU bodies (such as the European Parliament and other EU agencies) should be interested in the mapping of recommendations (e.g. strategies and policy priorities) and impacts of FLA. This information can also support activities aimed to set medium-to-long term priorities (e.g. Lisbon 2020 strategy) and proactively respond to emerging trends, tensions (unsustainable trends such as ageing) and potential transitions.

Based on the interviews to EC officials and the EFP Manchester Team views about the rationales for mapping FLA, we can conclude that, in the long-term, the mapping of FLA practices, players and outcomes will:

1. Contribute towards the creation of a FLA mapping and evaluation culture;
2. Guide the exploitation of completed, ongoing and prospective FLA;
3. Empower and interconnect FLA practitioners and users;
4. Build a more robust repository of FLA knowledge;
5. Support policy- and decision-shaping processes.

UNDERSTANDING THE SMART FUTURES PROCESS

The conceptual basis for mapping foresight and forward-looking activities is represented in the SMART Futures Jigsaw (see Figure 4). It contains 36 elements, which are related to the five phases of foresight, horizon scanning and forward-looking processes, namely: **Scoping**, **Mobilising**, **Anticipating**, **Recommending** and **Transforming**. Each of these phases and key elements are explained below.

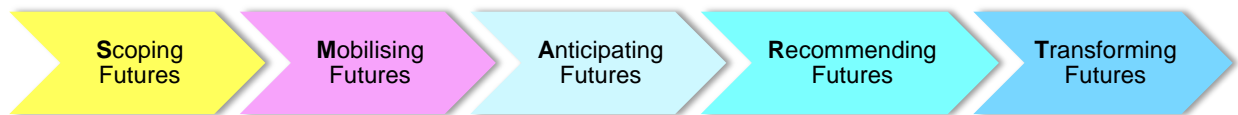
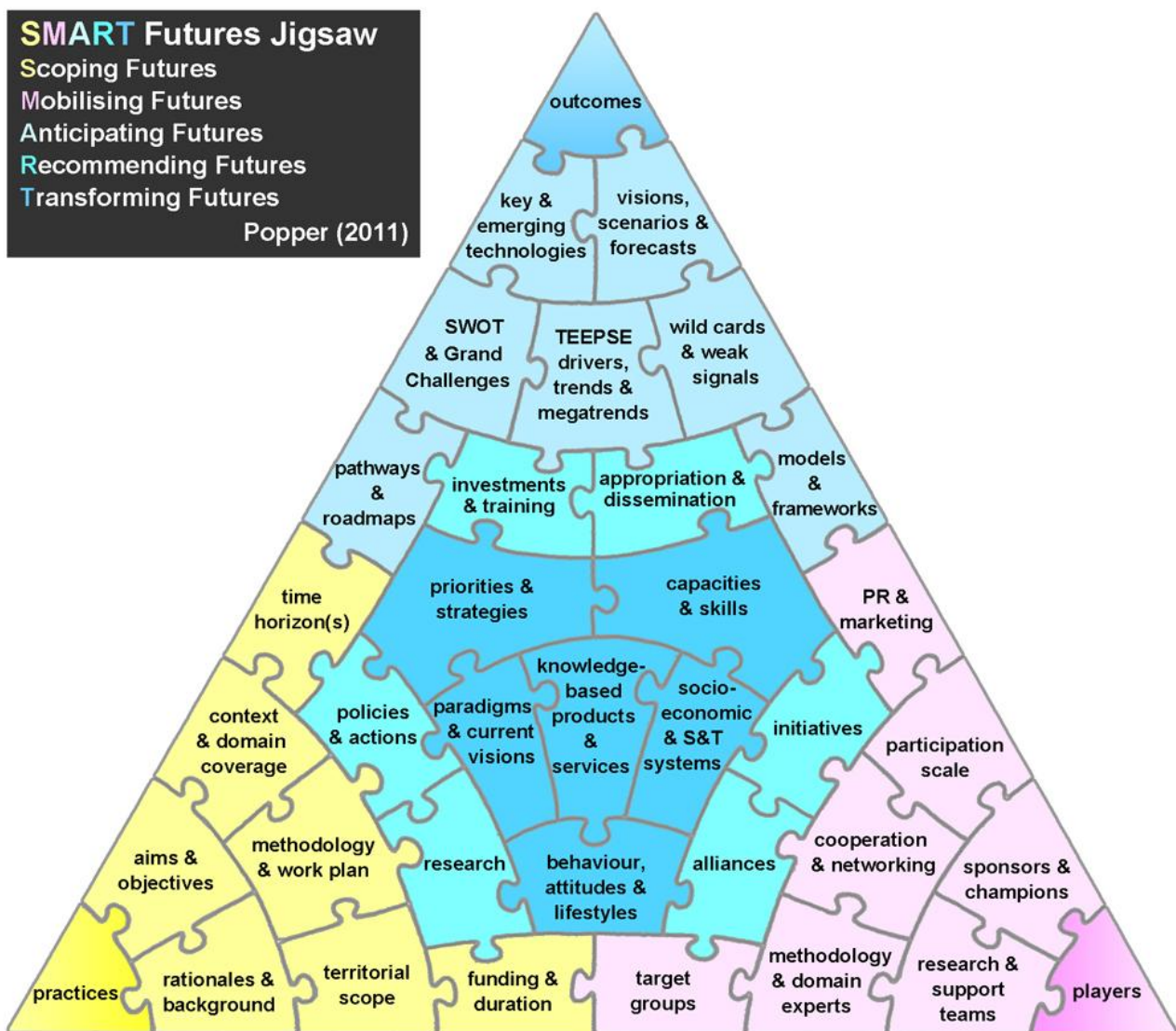


Figure 4: The SMART Futures Jigsaw

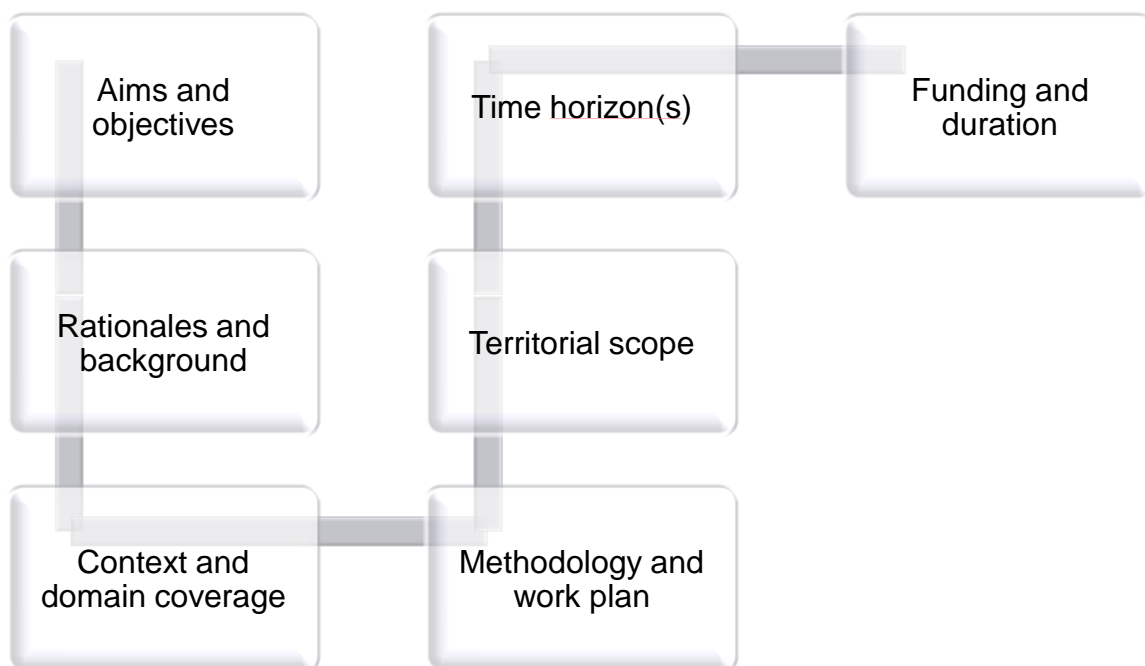


Source: Popper, 2011

Phase 1: Scoping Futures

The first phase of any forward-looking activity (FLA) is about scoping futures (see Figure 5). This involves the definition of the aims and objectives of the study, which are often related to a broader set of rationales (e.g. orienting policy and strategy development) and background conditions (e.g. events, documents, etc.). This is followed by the description of the context (e.g. EC funded FLA) and the domain coverage (e.g. energy, nanotechnology, security, etc.). Then the methodology is defined (by selecting and combining methods) and a clear work plan is prepared (by defining major activities, tasks and milestones). Next come the decisions about the territorial scope (considering the implications of choosing one or more of the following options: supra-national, national and sub-national) and the time horizon(s), in order to decide how far should we look into the future. Sometimes the funding and the duration of FLA are independently determined by the context (such as open calls for tenders, for example). However, even if the total funding and duration in months are pre-defined, it is important to make sure that the overall scope of the project is realistic considering available resources. The key elements of the scoping futures phase are used in the mapping of FLA practices.³

Figure 5: Key Elements of the Phase 1 of FLA – Scoping Futures

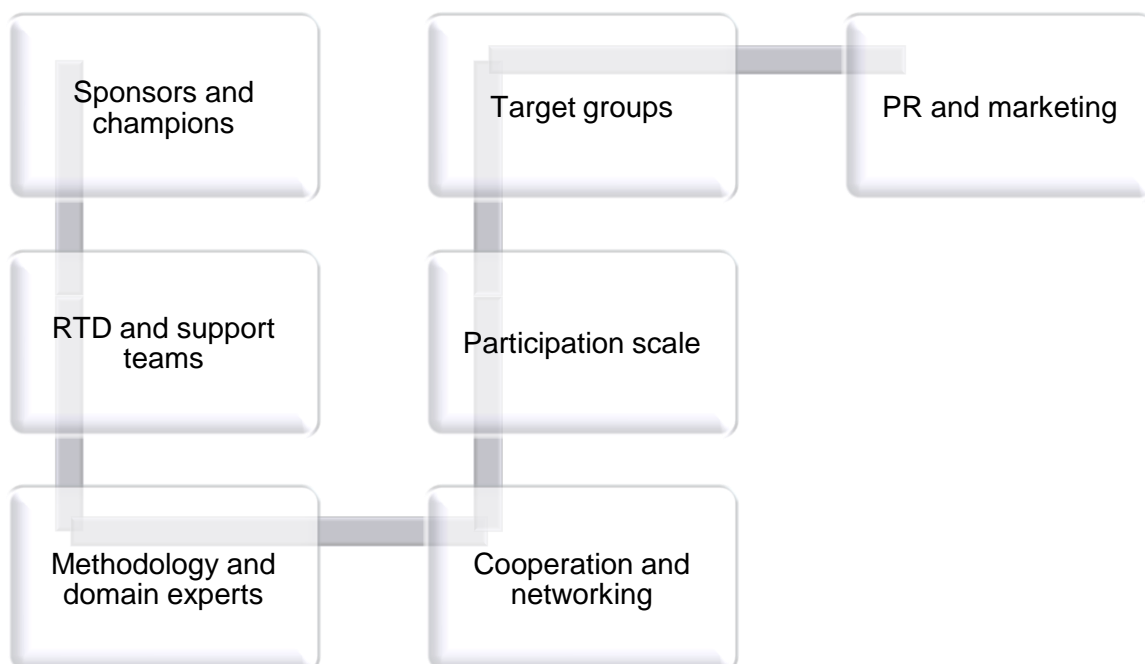


³ For a more detailed description see Section 4 of the 1st EFP Mapping Report (2011).

Phase 2: Mobilising Futures

For practical reasons mobilising futures is represented as the second phase of FLA (see Figure 6). However, some activities are simultaneously initiated with the scoping phase, such as contract negotiations with the sponsor or definition of the research and technology development (RTD) teams; while others run throughout the life of the project (e.g. engagement of target groups). This phase requires regular meetings and discussions with sponsors and champions (influential individuals capable of mobilising key stakeholders). The clear definition of capacities needed to conduct the study is one of the most critical success factors. By capacities we mean the RTD team (i.e. project leader, researchers and technology developers), support team (responsible for travel, logistical and administrative issues), methodology experts and domain experts (e.g. thematic specialists). Depending on the nature of the study (and of the sponsors!), the FLA team may need cooperation and networking to increase the participation scale and specific target groups (e.g. government organisations). Finally, one element that is often neglected or underestimated is the need for coherent public relations (PR) and marketing strategies. While the former helps to mobilise decision-makers, the latter is essential to communicate and disseminate key activities and findings. The main elements of the mobilising futures phase are used in the mapping of FLA players.⁴

Figure 6: Key Elements of the Phase 2 of FLA – Mobilising Futures

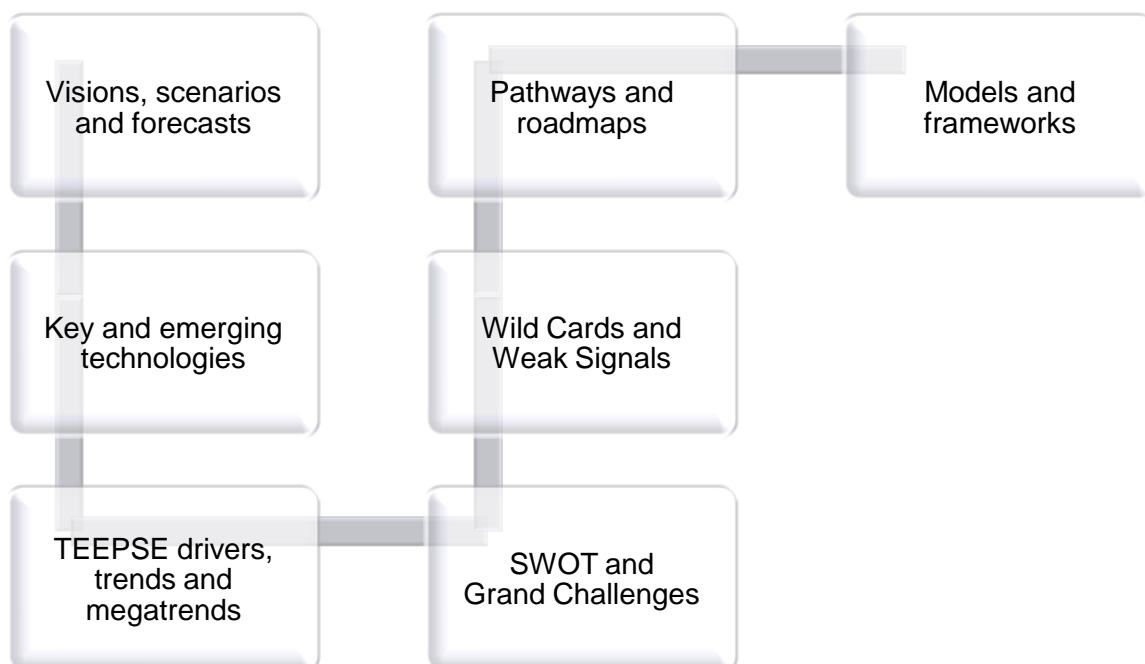


⁴ For a more detailed description see Section 5 of the 1st EFP Mapping Report (2011).

Phase 3: Anticipating Futures

The third phase of FLA is about anticipating futures, i.e. producing the “formal outputs” (see Figure 7). First we have *visions*, often described as desired or target futures. Then we find *scenarios* ranging from multiple possible futures to a single success scenario that could, but not necessarily, be used as a vision. In some FLA we can find *forecasts*, which are predictions or ‘informed guesses’ about the most probable futures. Some studies produce *lists of key and emerging technologies* where further research and investments may be needed. However, some of the most common immediate outputs of FLA include: lists of technological, economic, environmental, political and ethical (TEEPSE) drivers, trends and megatrends; as well as lists of strengths, weaknesses, opportunities and threats (SWOT) and *grand challenges* (problematic issues of sufficient scale and scope to capture the public and political imagination). More recently, we see a growing interest in the production and analysis of lists of *wild cards* and *weak signals*. More systematic and action-oriented studies tend to generate *pathways* (future directions) and *roadmaps* (details plans with one or more ways to achieve desired/target futures). Finally, we find *models* and *frameworks* (including conceptual, methodological and analytical ones) as typical outputs of evidence-based FLA. The main elements of the anticipating futures phase are used in the mapping of FLA outcomes.⁵

Figure 7: Key Elements of the Phase 3 of FLA – Anticipating Futures



⁵ For a more detailed description see Section 6 of the 1st EFP Mapping Report (2011).

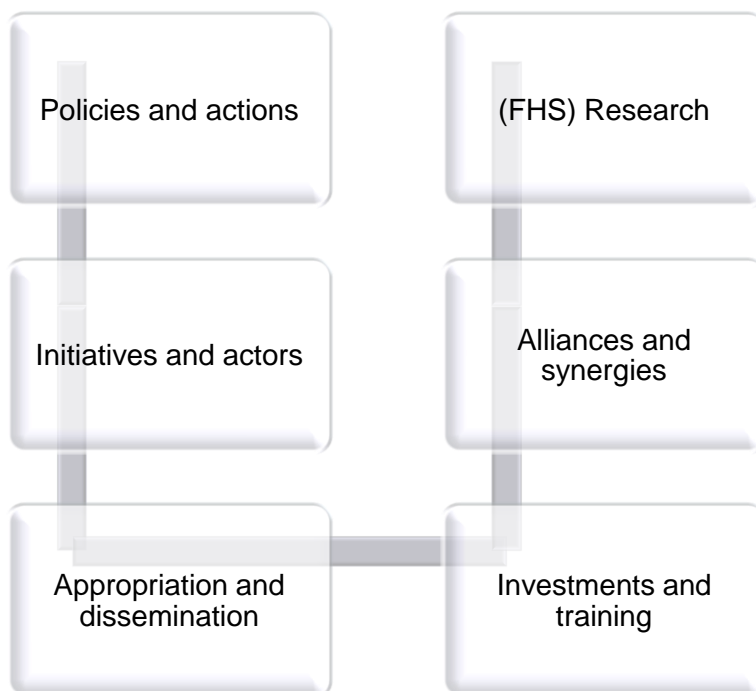
Phase 4: Recommending Futures

The fourth phase of FLA is about recommending futures (see Figure 8). Here we mean the codification and measurement of the extent to which FLA conducted at different levels (sub-national, national, European and international) generate different types of recommendations. However, the STI orientation of FLA players often (but not always) makes the recommendations more relevant for actors in the research and innovation system. Even where recommendations are not explicitly stated in “formal outputs” of FLA (e.g. reports), they may still be detected implicitly. For this reason, we should highlight a couple of points:

- *Recommendations are not the same as ‘Priorities’. The latter refers to topics and areas that have been identified as important in FLA. By contrast, recommendations refer to actions that should be taken to address priorities.*
- *Recommendations are wide-ranging in terms of what they cover and who they target. Policy recommendations are normally directed at the likes of ministries and other funding agencies, but recommendations from foresight panels and task forces often tend to be broader in scope and refer to a wider group of targets, including companies and researchers, etc.*

With these points in mind, we integrated the twelve types of recommendations used in the Global Foresight Outlook report (2007) into six broader categories.⁶

Figure 8: Key Elements of the Phase 4 of FLA – Recommending Futures



⁶ For a more detailed description see Section 6 of the 1st EFP Mapping Report (2011).

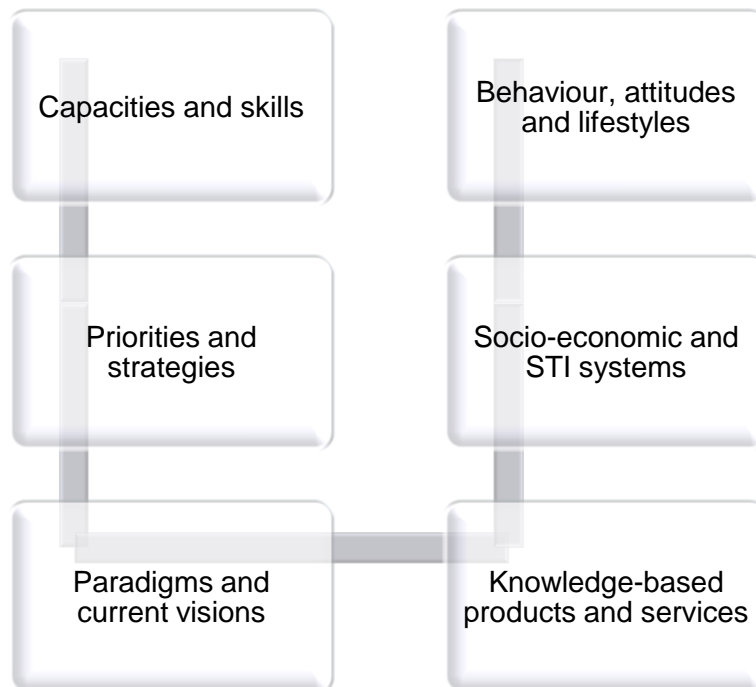
Phase 5: Transforming Futures

Finally, the fifth phase of FLA is about transforming futures (see Figure 9 below). Here we mean the ability to shape a range of possible futures (also known as ‘futuribles’) through six major types of transformations representing the ultimate outcomes or impacts of FLA:

- *Transforming capacities & skills, including:*
 - **capacities** for the design, implementation and evaluation of the 5 phases of FLA: scoping, mobilising, anticipating, recommending, and transforming (including evaluating and renewing);
 - **skills** for management, knowledge generation, systemic thinking, data handling, communication and social skills, technological, and methods usage?
- *Transforming priorities & strategies, including:*
 - **new/existing priorities** by positioning areas, challenges, policies, sectors, technologies, topics, etc.;
 - **new strategies** for business, innovation, research, policy, etc. and **existing innovation strategies, including:**
 - *Horizon 2020 Innovation Strategies:* strengthening Europe's science base; boosting Europe's industrial leadership and competitiveness; increasing the contribution of R&I to the resolution of key societal challenges; providing customer-driven scientific and technical support to Union policies; and helping to better integrate the knowledge triangle – by combining (a) research, (b) researcher training and (c) innovation.
 - *EU Innovation Strategies:* delivering growth and jobs through Innovation; strengthening the knowledge base and reducing fragmentation; getting good ideas to market; and leveraging EU policies externally.
 - *OECD Innovation Strategies:* empowering people to innovate; unleashing innovation in firms; creating and applying knowledge; addressing global and social challenges; improving the governance and measurement of policies for innovation.
 - *iKnow Innovation Strategies:* addressing grand challenges; addressing great responses; addressing emerging issues; addressing knowledge governance; and applying a ‘worldviews’ approach.
- *Transforming paradigms and visions.*
- *Transforming behaviour, attitudes and lifestyles.*
- *Transforming knowledge-based products and services, including:*
 - *General advancement of knowledge*
 - *Commercial exploitation of R&D results*
 - *Exploitation of research & innovation results via standards*
 - *Exploitation of results through public policies*
 - *Exploitation of results through (social) innovation*

- *Transforming socio-economic/industrial and STI systems, including:*
 - ***socio-economic/industrial systems**, by: replacing products and services being phased out; improving products and services quality; extending products and services range; maintaining traditional market share; creating new markets; ensuring compliance with modern standards; increasing flexibility of production; increasing industrial capacities; reducing labour costs; reducing materials costs; reducing energy costs; reducing environmental damage; and improving working conditions.*
 - ***science, technology and innovation (STI) systems**, by: forecasting TEEPSE events/developments; orienting policy and strategy development; recognising drivers/impacts of TEEPSE changes; engaging key stakeholders and decision-shapers; supporting STI priority-setting and governance; identifying key/emerging TEEPSE issues; generating (shared) visions and scenarios; harmonising (STI) supply and demand needs; transforming/absorbing capacities and methodology; identifying risks, grand challenges and opportunities; networking and international cooperation; and generating bridges between science and policy.*

Figure 9: Key Elements of the Phase 5 of FLA – Transforming Futures



METHODOLOGY FOR THE MAPPING OF 50 FLA CASES

Here we describe how we selected the case studies of forward-looking exercises mapped in EFP. We will briefly characterise the mapping challenge, outline how the 50 cases mapped by the EFP team were selected and, finally, discuss the process how we intend to nominate further cases in the future. The reader will gain a more comprehensive understanding of the selection processes and criteria.

The challenge

The mapping of case studies for the European Foresight Platform faced two main challenges: what cases were going to be mapped and how was the information getting into the Mapping Environment? – Available online at www.mappingforesight.eu. These questions concern the issue of how the projects were identified as interesting for EFP and subsequently nominated for the mapping process. In other words, how to feed the Mapping Environment and how to ensure the quality of the feed in different phases of the project? In addressing these questions we distinguish three phases:

- In a first phase, a process was installed by which it was possible to identify a critical number of cases (50) for a first round of mapping, carried out by the EFP project team. These cases served as a basis to demonstrate the validity of the SMART Futures framework, to illustrate the possible analyses that can be made on the basis of the mapped data and to create a critical mass that will attract further participants.⁷
- In a second step we commissioned the import about a 1000 cases from the EFMN database into the EFP Mapping Environment.
- In a third phase, we developed a mechanism that will hopefully motivate others to actively contribute to the Mapping Environment in the future and to submit information about their and other FLA to the platform.

While for the first phase we have chosen to follow a top-down approach, the use of the Mapping Environment promotes a more bottom-up mapping approach in the future.

Mapping of FLA cases by the EFP team

During the first mapping phase the EFP team mapped all in all 50 case studies. But how did we arrive at these particular cases? The University of Manchester nominated 41 out of 50 cases following a two-step process of *identification* and *selection*. The remaining nine cases were nominated by the other EFP partners, namely: AIT, IPTS, and TNO.

⁷ For more detailed information about the results of the first mapping phase of 50 cases, see 2nd EFP Mapping Report (2012) and 3rd EFP Mapping Report (2012).

Identification of FLA cases

In a first step we identified in a top-down manner about 150 FLA cases.⁸ They were identified by searching the websites of significant FLA sponsors such as the EC, the governments of the EU Member States, USA, Canada, India, Russia and several Latin American countries. The expertise and acquaintance of EFP team members with different types of FLA in these regions was key for the identification of cases. In addition, we carried out a simple survey among selected professional contacts in France and the USA to suggest projects they consider to be relevant for EFP. The filter was very broad and included all types of FLA, sizes of funding, topics, domains etc.

Selection of 50 FLA cases

In a second step we filtered the list of cases. Out of the 150 cases we selected about one third by using four different criteria:

- The project addresses one of the themes of the EC Framework Programme;
- The selection includes different countries and world regions;
- Presence of different types of FLA projects i.e. of forecast, horizon scanning, foresight, impact assessment and other types of FLA.
- European Commission request to focus the mapping on Security and Health FLA in order to produce sector-oriented reports.

The list of 50 projects mapped in EFP is available online in the Mapping Environment at <http://www.mappingforesight.eu/analysis/>. EFP Community Members and visitors of the Mapping Environment can display and filter FLA cases using a number of criteria, including *dynamic visualisation and analysis* of projects based on their relevance by:

- World regions (Europe, Africa, Asia, Oceania, South America and North America)
- EC Framework Programme (FP7) Thematic areas
- FRASCATI areas
- NACE sectors
- Type of FLA (foresight, horizon scanning, forecasting and impact assessment)
- Methods
- Recommendations
- Text (open search using all mapping text, titles, keywords and description)

In addition, the Mapping Environment allows the *sorting* of projects by:

- Name
- Popularity (number of hits)
- Date of insertion
- Date of last update

⁸ The 150 cases were listed in an internal EFP management document.

Mapping sources

When a researcher mapping FLA cases (EFP Mapper) was not involved in the project, the mapping process envisaged the use of publicly available information in the first instance (e.g. project website, interim/final reports, publications, newsletters, briefs, etc.) and information provided in interviews in the second.

THE MAPPING ENVIRONMENT: SHARING FLA KNOWLEDGE

The Mapping Environment is a multi-purpose platform aimed to monitor, analyse and position (MAP) forward-looking activities (FLA) in Europe and the world. This is a unique space where both EFP Community members and unregistered visitors are able locate and share knowledge on forward-looking research and innovation initiatives, which are often associated to one or more of the following future-oriented approaches: foresight, horizon scanning, forecasting and impact assessment.

Figure 10: EFP Mapping Environment – www.mappingforesight.eu

The screenshot displays the EFP Mapping Environment website. At the top left is the EFP logo, a stylized green eye with a red lip. To its right is the text 'efp' and the tagline 'supporting forward looking decision making'. Further right are login fields for 'Username' and 'password', and links for 'Register' and 'Lost password'. Below the header is a navigation bar with buttons for 'Analysis', 'Mapping FLA', 'Reports', 'e-Book', 'FLAME', and 'EFP home'. The main content area is divided into two columns. The left column contains a 'Welcome' button and a 'Foresight (24)' dropdown menu with sub-items: ASIA (2), AFRICA (0), EUROPE (19), OCEANIA (0), SOUTH AMERICA (2), and NORTH AMERICA (1). Below this are buttons for 'Horizon Scanning (4)', 'Forecasting (9)', and 'Impact Assessment (13)'. The right column is titled 'Analysis' and features a 'SEARCH BY World regions' dropdown menu above a world map. The map is color-coded by region: North America (dark blue), South America (green), Europe (light blue), Africa (orange), Asia (yellow), and Australia (purple). Below the map are three search buttons: 'SEARCH BY FP7 relevance', 'SEARCH BY FRASCATI relevance', and 'SEARCH BY NACE relevance'.

Relevance by world regions

From the 50 FLA cases forty-one (82%) were from Europe and the remaining 9 cases (18%) represent other world regions (see Figure 11).

Figure 11: 50 FLA cases by world regions



Relevance by FP7 thematic areas

The mapping of FLA cases involved the assessment of their overall relevance by EC Framework Programme (FP7) thematic areas.⁹ Figure 12 shows that although we have 20 and 16 cases specifically related to Health and Security areas, respectively; there are cases from other thematic areas that are also relevant for Health and Security. However, in the 2nd and 3rd EFP Mapping Reports we analysed sector-specific cases.

Figure 12: 50 FLA cases by EC FP7 thematic areas

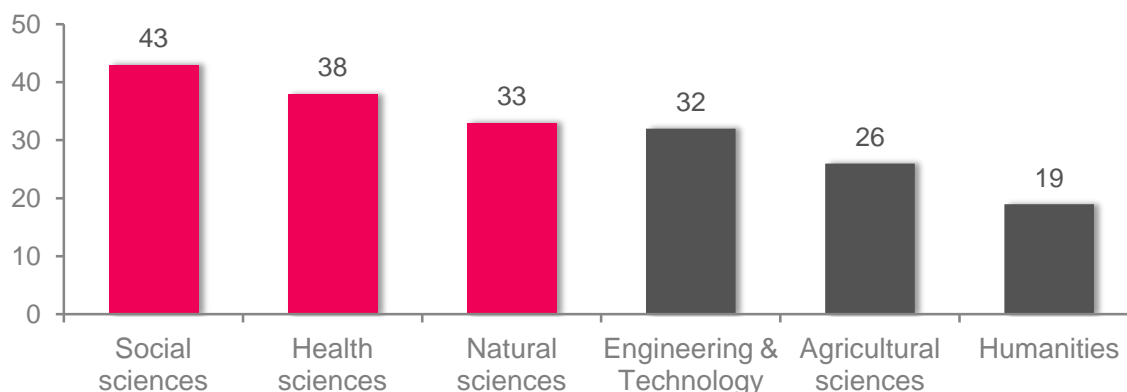


⁹ Ten thematic areas were prioritised in FP7: Theme 1 – Health; Theme 2 – Food, Agriculture and Fisheries, Biotechnology (KBBE, for knowledge-based bio-economy); Theme 3 – Information & communication technologies (ICT); Theme 4 – Nanosciences, nanotechnologies, materials & new production technologies (NMP); Theme 5 – Energy; Theme 6 – Environment (including Climate Change); Theme 7 – Transport (including aeronautics); Theme 8 – Socio-economic Sciences and the Humanities (SSH); Theme 9 – Space; and Theme 10 – Security.

Relevance by FRASCATI areas

Figure 13 shows that most of the 50 FLA cases are mainly relevant to three FRASCATI research areas, namely: natural sciences, social sciences and health sciences. This basically reflects the EC request to select and map cases in the Security and Health areas.

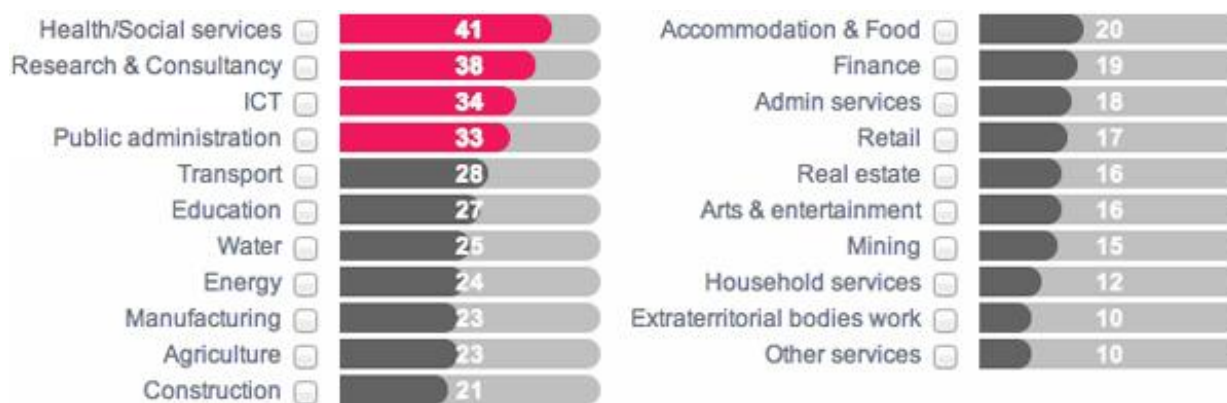
Figure 13: 50 FLA cases by FRASCATI areas



Relevance by NACE sectors

Figure 14 shows the relevance of the 50 FLA cases to the socioeconomic sectors of the NACE classification. The category *Health/Social services* is on top of the list due to our focus on Health FLA. Similarly, security and defence are in the *Public administration* category, thus explaining its position in the top 4.

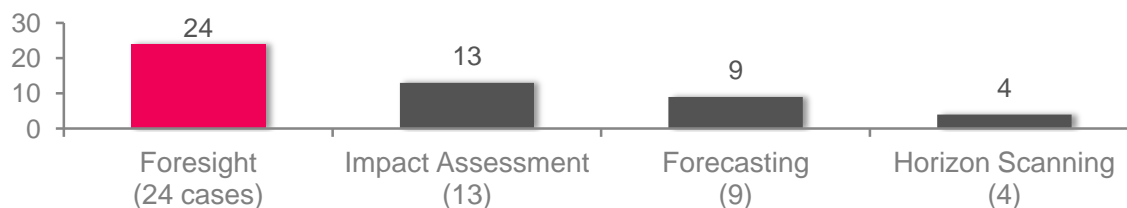
Figure 14: 50 FLA cases by NACE areas



Relevance by type of FLA

Figure 15 shows that nearly half of the 50 FLA cases are *foresight* studies, followed by 13 *impact assessment*, 9 *forecasting* and 4 *horizon scanning* studies.

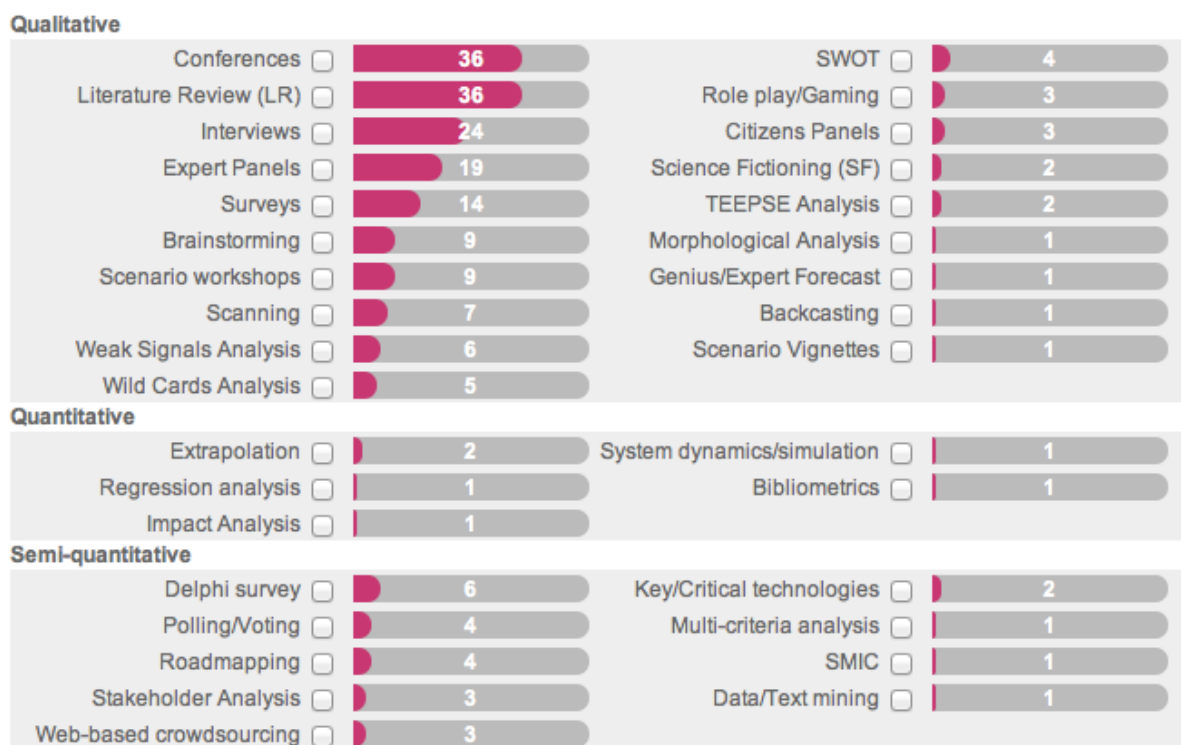
Figure 15: 50 FLA cases by type of FLA



Relevance by methods

Figure 16 shows a dominance of qualitative methods. Conferences/workshops and literature reviews are the most common qualitative methods (36 studies), followed by interviews (24), expert panels (19), surveys (14) and brainstorming (9). In terms of quantitative methods, trend extrapolation is used in two studies, and methods like regression analysis, impact analysis, system dynamics and bibliometrics are only used in one case. Delphi, polling and roadmapping are common semi-quantitative ones.

Figure 16: 50 FLA cases by methods



Searching and sorting cases in the Mapping Environment

Figure 17 shows a screenshot of the user-customised analysis, searching and sorting functionalities in the Mapping Environment.

Figure 17: Searching and sorting FLA cases

▶ SEARCH BY World regions

▶ SEARCH BY FP7 relevance

▶ SEARCH BY FRASCATI relevance

▶ SEARCH BY NACE relevance

▶ SEARCH BY Type of FLA

▶ SEARCH BY Methods

▶ SEARCH BY Recommendations

▼ SEARCH BY Text relevance

Search Reset

All Title Keywords Description | Sort by Popularity

« < 1 2 3 4 5 > »

iKnow - interconnecting Knowledge on S&T Issues

iKnow is one of six Blue Sky foresight research projects funded by the European Commission's Seventh Framework Programme for Research and Technology... [more »](#)

grand challenges, wild cards, weak signals, science, technology, innovation, policy, ERA | Mapping Progress: 100 %

CfWI - Developing public health skills and workforce

This project is a horizon scanning study on public health carried out by The University of Manchester at the request of CFWI. The intention, in light of... [more »](#)

healthcare, public health, social care, workforce, horizon scanning, big picture challenge | Mapping Progress: 84 %

SESTI - Scanning for Emerging S&T Issues

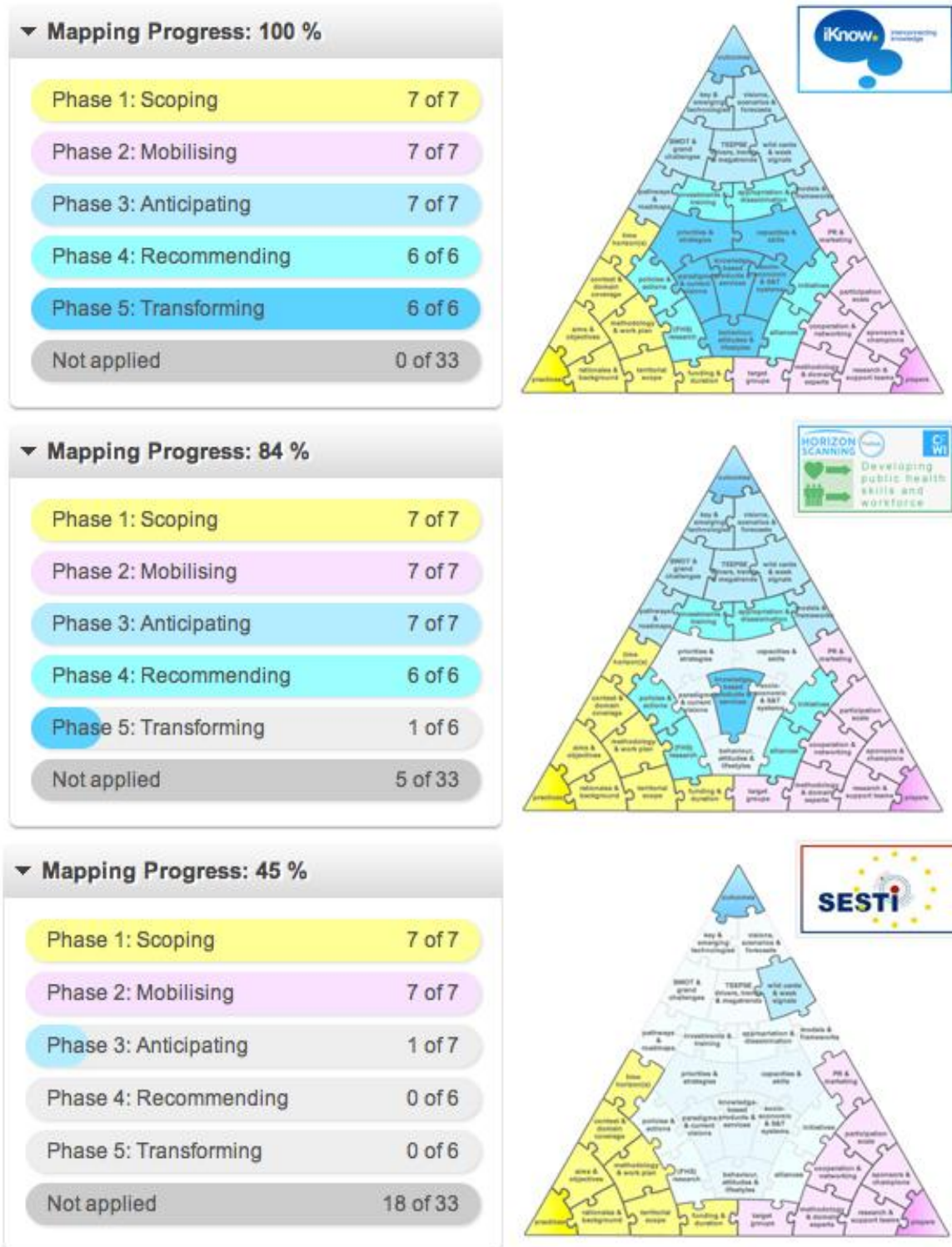
The overall goal of the project is to contribute to the development of an effective system for the early identification of weak signals of emerging issues.... [more »](#)

science and technology; weak signals; scanning; research policy; emerging issues | Mapping Progress: 45 %

Displaying FLA mapping progress

Figure 18 shows how the Mapping Environment displays the mapping progress of three FLA cases on 17.12.12: iKnow (100%), CfWI Public Health (84%) and SESTI (45%).

Figure 18: Displaying FLA mapping progress



SECURITY FUTURES: MAPPING OF 16 SECURITY FLA CASES

The 2nd EFP Mapping Report analysed 16 FLA cases. Table 1 shows some basic information about the selected cases: project title, short name, coordinating country and type of FLA.

Table 1: Security FLA cases analysed in the 2nd EFP Mapping Report

Project Title	Short name	Coord. Country	Type of FLA
1. DCDC Global Strategic Trends 2040	DCDC-GST-2040	UK	Forecasting
2. ESPAS Global Trends 2030	ESPAS-GT-2030	EU	
3. NIC Global Trends 2025	NIC-GT-2025	US	
4. Europe's evolving security: drivers, trends and scenarios	FORESEC	FI	Foresight
5. The future impact of security and defence policies on the European research area	SANDERA	UK	
6. Changing Multilateralism	EU-GRASP	BE	
7. Foresight of evolving security threats posed by emerging technologies	FESTOS	IL	Horizon Scanning
8. Security Jam 2012	Security Jam	NATO	
9. Privacy awareness through security branding	PATS	DE	Impact assessment
10. Strategic Risk Assessment and Contingency Planning in Interconnected Transport Networks	STARTRANS	LU	
11. Aftermath Crisis Management System-of-systems Demonstration	ACRIMAS	DE	
12. Security of road transport networks	SERON	DE	
13. European Risk Assessment and Contingency planning Methodologies for interconnected networks	EURACOM	BE	
14. Assessment of Environmental Accidents from a Security Perspective	SECURENV	HU	
15. Decision support on security investment	DESSI	DK	Impact assessment
16. Security Technology Active Watch	STRAW	ES	

The 16 selected cases represent all four types of FLA. However, some points are worth noting here. Historically security FLA have been carried out by military strategists, e.g. in Ministries of Defence, at universities and dedicated think tanks. While these have combined experts from a variety of fields including history, economics, and politics, the emphasis on statistical modelling of the 1950, 60s and 70s has given way to a more qualitative engagement with strategic issues that is more akin to *foresight* work. This is not to say that technology assessments or econometric analyses are not done in this area. However, they are more supportive rather than guiding the work nowadays.

Secondly, the main developments in security policy and academic security research in the past two decades are mainly linked to conceptual and institutional rather than technological innovations. Since the end-1980s the concept of security has been altered to mean more than 'merely' a state of safety for the nation state mainly achieved by military means. No doubt, technological developments are among the factors that have led to such changes – as are the end of the cold war, the foundation of the European Union, continued and accelerating globalisation and Europeanisation. However, the emphasis has been on new concepts, policies and institutions, phenomena that appear to be more adequately captured by foresight than by forecasting methods.

Thirdly, and here a certain selection bias plays out, most cases under consideration are FP7 funded studies. In other words, the mapping has so far focused on EU security studies and, therefore, on projects dealing with security at EU level. Traditionally, security and defence issues have not loomed large among EU policies, as this topic has been a (tightly guarded) domain of member states' governments and subject to bi- or multilateral cooperation among them. Consequently, the EU security policy field is still being formulated. This is another reason for foresight-related methodologies (emphasising conceptual aspects, vision building and close engagement of all relevant stakeholders).

A last point to make is that 'impact assessment' as well as 'forecasting' studies usually take the form of 'risk assessments' in the field of security. These mainly deal with identification of trends (as in the two forecasting cases in the table) or estimation and managements of threats and risks of various types (environmental accidents, risks in transportation and inter-connected networks, crises management, etc.).

Geographically speaking, the mapped cases mainly refer to the EU region. However, they may also cover non-EU countries like the US (PATS, NIC-GT-2025) or have no specific geographical scope such as the NATO study (Security Jam, 2012).

AIMS AND OBJECTIVES

The security theme of EC FP7 gives emphasis in increasing security of citizens, infrastructures and utilities; intelligent surveillance and border security; restoring security and safety in case of crisis; improving security systems integration, interconnectivity and interoperability; studying socio-economic, political and cultural aspects of security, ethics and values; and supporting security research coordination and structuring. In this regard, in the selected FLA 'security' is understood in a broad sense: a referent object (state, society, human being) is to be 'care free' (from hazards, threats etc.) and might take action to this end (prevent, protect, defend, insure or increase resilience).

As a consequence the FLA studies under consideration:

- examine future developments in defence and homeland security;
- look at internal and external dimensions of security;
- address the security of various referent objects;
- examine the evolvement of different types of threats; and
- discuss policy or conceptual developments.

Within this framework, the main aims of the FLA in the security area have been ‘to transform strategies and priorities’ and also ‘current visions and paradigms’, as well as ‘capacities and skills’. The next major aim is to ‘transform knowledge-based products and services’. Overall, there is a focus on an ambition towards common activities and shared ways of doing things, which may reflect the fact that European security policy has not yet reached a degree of maturity. At the same time there is a trend to improve capacities, skills and services provided. This is reflected mainly in FLA that aim also at producing certain models for risk assessment and management or analytical and conceptual frameworks.

RATIONALES

Apart from ‘orienting policy and strategy development’ the main rationale for conducting FLA in the security area has been to ‘engage key stakeholders and decision shapers’. This is not surprising given the focus on EU level security issues of the FLA activities under consideration here. European Security and Defence Policy is still in its formative period; the relevant stakeholders used to a national framework of reference are yet to be linked; institutions and mind frames geared towards transatlantic cooperation need to be altered to include a layer of European collaboration. Closely related to this most important rationale of FLA in the security domain is the notion ‘to generate shared visions and scenarios’ of European security. The latter can be regarded as a means to engage stakeholders and decision shapers in a meaningful way and to initiate a process in which they start addressing the issue area of security in a new way.

At the same time, ‘identifying risks, grand challenges and opportunities’ is among the most important rationales. This type of rationale mainly reflects the focus of the risk assessment studies mapped along with ‘identifying key/emerging TEEPSE issues’ and ‘recognising drivers/impacts of TEEPSE changes’.

Anticipating security futures

The 2nd EFP Mapping Report offers a detailed discussion about several outcomes from the 'anticipating' phase of Security FLA. This section highlights some key results.

SECURITY DRIVERS, TRENDS, MEGATRENDS AND GRAND CHALLENGES

Not surprisingly, there is no clear separation between drivers, trends, and megatrends. It is also often the case that what is emphasised as megatrends or trends is also implicitly or explicitly linked to certain (grand) challenges. However, the analysis is not of a generic type but focuses on the security perspective. Some issues are mentioned in more than one group (as both trend and challenge for instance) while some clustering would also make sense. This is attempted in the following paragraphs.¹⁰

Globalisation is a major driver of evolutions with significant implications for security. Globalisation is likely to raise the level of interdependence between states and individuals within the globalised economy. Resources, trade, capital and intellectual property are likely to rely on complex networks of physical and virtual infrastructure that are likely to be vulnerable to physical disruption or cyber-attacks by multiple actors. Consequently, increasing dependency on this infrastructure, and the global supply chains that underpin globalisation, will leave the global economy vulnerable to disruption. (DCDC-GST-2040)

One of the main trends mentioned in the security FLA is the **emergence of new centres of power** and the consequent **redistribution of global power**. (EU-GRASP, NIC-GT-2025) The emergence of new powers is first addressed as a key driver. Associated to this is the shift of power to Asia recorded as a major trend. In particular the world of 2030 will be diffusely multipolar and polycentric. Polycentrism will be accompanied by an economic power shift toward Asia, where over half of the world's population will be concentrated by 2030. China is projected to be the largest economic power and India will continue to rise. Both countries will face major structural challenges, however. Brazil may become a successful example of sustainable development during the next two decades. Russia and Japan will lose the great power status they enjoyed in the twentieth century. (ESPAS-GT-2030)

A constellation of rising middle powers, including Indonesia, Turkey, and South Africa, will become ever more prominent. (NIC-GT-2025) The international system that is likely to emerge as a result of all these shifts will probably mix balance-of-power politics and multilateralism, with states making issue-by-issue shifts and alliances. This will generate a higher level of unpredictability in international relations, and make it harder to attain a broad consensus even on matters requiring urgent global action. (ESPAS-GT-2030) This shift of global power is likely to result in a period of instability in international

¹⁰ This section shows selected extracts from the 2nd EFP Mapping Report (Amanatidou *et al*, 2012).

relations, accompanied by the possibility of intense competition between major powers as there will be several states and institutions competing for regional and global influence, cooperating and competing within the international community. (DCDC-GST-2040)

Redistribution of power on a global scale is addressed as a megatrend. Following the emergence of new powers this redistribution is marked by a move away from the United States (US) and Europe towards Asia and is also pushed by the urgency of global challenges (the financial crisis, climate change, maritime security, resource scarcity and population growth) (Security Jam 2012, NIC-GT-2025, DCDC-GST-2040)

The grand challenges addressed in the security FLA are climate change, scarcities, global inequalities, changing demographics and migration.

Climate change has a central position in the analysis of trends and challenges, the focus being on the impacts from climate change. Temperature increases are likely to lead to significant environmental change that may, for example, include desertification in the Saharan margins and changes to rainfall distribution patterns within the monsoon belt of the Arabian Sea and South Asia. The frequency and intensity of extreme weather events will change, possibly with severe impact on low-lying coastal regions. Rapid glacial melt, particularly in the Himalayas, may exacerbate water management problems in China, India, Pakistan and Bangladesh. Disease carriers, such as malarial mosquitoes, are likely to spread into previously temperate zones. (DCDC-GST-2040)

Special reference is being made on the consequences of climate change affecting living standards and public safety by exacerbating water and food scarcity with environmental degradation expected to continue to provoke humanitarian disasters, including desertification and floods of increasing magnitude. The severest impact will be felt in China, South Asia and the Sahel, where millions of people will be displaced; but no region of the world will be spared. (ESPAS-GT-2030)

Scarcity in energy, food and fresh water resources is also separately addressed in relation to the social unrest and conflicts they may cause. The frequency, scale and duration of humanitarian crises are likely to increase. Many states, including China and India, are likely to become more dependent on food imports to feed their large and increasingly affluent populations. A shift in agricultural patterns and the distribution of grain growing areas, coupled with the rise in animal and plant diseases, is likely to disrupt food production, resulting in increased migration. However, improvements and efficiencies in agricultural production are likely to meet much of the increased demand, given likely scientific advances that develop high-yield, disease resistant crop strains, combined with better land usage and improved irrigation. The oceans will be further exploited for protein, raising the demand for fishing rights in previously inaccessible areas, e.g. Polar Regions. (DCDC-GST-2040) Humanitarian crises due to water scarcity

and related food and health emergencies may become recurrent, particularly in some parts of Africa. Competition for resources is likely to exacerbate tensions and trigger conflicts. Energy crises will heighten the sense that the world is entering an 'age of scarcity', putting the prevailing model of development into question. (ESPAS-GT-2030)

Inequalities of opportunities is another grand challenge due to globalisation and increased access to more readily and cheaply available telecommunications. This type of inequality is likely to be a significant source of grievance, possibly resulting in an increased incidence of conflict. However, states that experience lower birth rates and increased longevity are likely to benefit from a growing workforce and a falling dependency ratio. The result is a 'demographic dividend', which can produce a virtuous cycle of growth. (DCDC-GST-2040)

Demographic trends are also mentioned among the grand challenges as possible causes of tensions. Demographic trends may fuel instability especially in the Middle East, Central Asia and sub-Saharan Africa. The developing world will account for most of the growth, remaining relatively youthful, in contrast to the developed world and China, which will experience little population growth and undergo significant increases in median age. In the West, however, ageing is likely to lead to policies to employ the 'younger old'. This cultural shift may yield a second demographic dividend leading to a lower demand for migrant workers and decreasing the social welfare burden. (DCDC-GST-2040) The populations of several youth-bulge states are projected to remain on rapid growth trajectories. Unless employment conditions change dramatically in parlous youth-bulge states such as Afghanistan, Nigeria, Pakistan, and Yemen, these countries will remain ripe for continued instability and state failure. (NIC-GT-2025)

Nevertheless, populations in many affluent societies are likely to decline, encouraging economic **migration** from less wealthy regions. Environmental pressures, economic incentives and political instability will continue to drive population movement from afflicted regions. Conflict and crises will also continue to result in the displacement of large numbers of people. Such movement is likely to occur in regions of sub-Saharan Africa and Asia. (DCDC-GST-2040)

Health is another major issue among the trends examined by security FLA with significant implication due to expected inequalities, movement of people and rising migration. By 2040, health will be recognised as a fundamental global issue. Average global life expectancy is likely to increase but access to healthcare is likely to remain unequal between the developed and developing worlds and, at the national level, between different socio-economic groups. Dependence on international trade, relatively unconstrained movement of people, and high levels of legal and clandestine migration will minimise the opportunities to isolate outbreaks. (DCDC-GST-2040)

It is recognised that these trends and megatrends along with the challenges humanity is facing call for global responses. However **global initiatives** also hide a number of **gaps**. The ability of new constellations or ‘hubs’ of states to address grand challenges such as financial crises, climate change and resource scarcity to find shared solutions will be partial at best. There will be increasing pressure to reform multilateral institutions to reflect shifting power relations, including a drive towards greater inclusiveness. While the shift away from the Atlantic will be contested and may produce serious tensions, the overarching trend may well be towards convergence. It is likely that this shift in the global agenda will make consensus on international military interventions more dependent on a UN mandate than in the past. (ESPAS-GT-2030)

However, in a world characterised by the diffusion of power, meeting the challenges of human development will depend increasingly on **non-state actors**, be they private companies, non-governmental organisations (NGOs), or philanthropic institutions. Non-state actors, in particular national and transnational civil society networks and private corporations, will play a critical role in the coming decades. Their power and influence will be greater than that of many states, and may lead to new forms of governance and civic action. The devolution of power to federated states and regional and local authorities will continue and even accelerate. But not all contributions by private actors will be positive: extremist non-state actors are likely to present a threat to the well-being of human communities. (ESPAS-GT-2030)

The rising power of non-state actors vis-à-vis the state is a central theme examined from several perspectives. Concurrent with the shift in power among nation-states, the relative power of various non-state actors—including businesses, tribes, religious organizations, and criminal networks—is increasing. The global political coalition of non-state actors plays a crucial role in securing a new worldwide climate change agreement. In this new connected world of digital communications, growing middle classes, and transnational interest groups, politics is no longer local and domestic and international agendas become increasingly interchangeable. (NIC-GT-2025)

Main drivers for the empowerment of individuals are key developments in several spheres including the global emergence of the middle class, particularly in Asia, near-universal access to education, the empowering effects of information and communications technology (ICT), and the evolution in the status of women in most countries. (ESPAS-GT-2030)

In turn the impacts from the empowerment of individual and non-state actors are addressed. In democratic societies, new forms of protest and anti-establishment politics may emerge in response to a growing expectations gap, deepening income disparities, and the power shifts that are limiting the action of countries that have been used to acting as major global players. From the security perspective it is expected that over the

next two decades the cyber sphere is likely to become an arena of conflict and tension between states of all political stripes, and also between individuals or private companies. It is likely that some governments will be more concerned with cyber security, control, surveillance and regulation than with protecting freedom of access. (ESPAS-GT-2030) Intrinsic to the growing complexity of the overlapping roles of states, institutions, and non-state actors is the proliferation of political identities, which is leading to establishment of new networks and rediscovered communities. No one political identity is likely to be dominant in most societies by 2025. Religion-based networks may be quintessential issue networks and overall may play a more powerful role on many transnational issues such as the environment and inequalities than secular groupings. (NIC-GT-2025)

The examination of the **role of the individual** in future societies goes even further indicating the citizens of 2030 will be very much more aware that they are part of a single human community in a highly interconnected world. This may signal the rise of a new 'age of convergence.' Democratic aspirations will tend to be perceived as compatible with, and even as facilitating, a greater awareness of national and sub-national cultural identities. (ESPAS-GT-2030)

The **role of women** is also examined. Over the next 20 years the increased entry and retention of women in the workplace may continue to mitigate the economic impacts of global aging. Examples as disparate as Sweden and Rwanda indicate that countries with relatively large numbers of politically active women place greater importance on societal issues such as healthcare, the environment, and economic development. If this trend continues over the next 15-20 years, as is likely, an increasing number of countries could favour social programs over military ones. Better governance also could be a spinoff benefit, as a high number of women in parliament or senior government positions correlates with lower corruption. (NIC-GT-2025)

The **current economic crisis** is referred to as a driver that may reverse the trend of decreasing inequalities due to the emergence of a middle class in Asia, Latin America and also Africa. Overall, however, inequality will tend to increase and **poverty and social exclusion** will still affect a significant proportion of the world population. (DCDC-GST-2040) At the same time increasing social and economic pressures may undermine liberal institutions and the long-term prospects for greater democratization. (NIC-GT-2025)

Other trends refer to the main aspects of security that will attract attention in long-term strategic planning. These are proliferation (including by non-state actors), cyber security or instability emanating from failing states – humanitarian crises, piracy and organised crime – and the protection of natural resources and access to energy.

The **proliferation** of modern weapons' technologies will generate instability and shift the military balance of power in various regions. Nuclear weapons are likely to proliferate. Terrorist groups are likely to acquire and use chemical, biological and radiological or nuclear (CBRN) weapons possibly through organised crime groups (DCDC-GST-2040) but a major conflagration involving CBRN weapons is not likely to happen over the next two decades. (ESPAS-GT-2030, NIC-GT-2025)

Increasing dependence on ICT and reliance on space-based assets to receive or transmit information across the electromagnetic spectrum, will maintain the importance of **cyber security**. Attribution, intent and legitimacy of cyber-attacks will all be disputed. (DCDC-GST-2040)

The possibility of **inter-state conflict** cannot be discounted entirely. Looking ahead to 2030, the border tensions between China and India over water resources have the greatest potential to disrupt international peace. Conflicts are also foreseen due to current tensions between Algeria and Morocco over the Western Sahara; the problems emerging as a result of the possible collapse of North Korea; and unresolved conflicts in Eastern Europe. **Tensions over raw materials** may also cause conflict and require new forms of crisis management. Intra-African and trans-regional **forced migration** due to economic factors, conflicts and environmental degradation will tend to grow. Wars fuelled by **nationalism and extremist identity** politics, and the associated dangers of mass murder and genocide, will be in the core security challenges of the coming decades. (ESPAS-GT-2030)

Despite the emergence of a possible 'age of convergence', **ideologically-driven conflicts** is another form to continue to exist. The social tensions caused by intrusive global culture are likely to be most acute amongst those who seek to maintain their indigenous and traditional customs and beliefs, and feel threatened by changes. (DCDC-GST-2040)

At the same time economic and social difficulties in some countries will lead to extremist identity politics and xenophobia. New ideologies will emerge, driven by religion, ethnic differences, nationalism, inequality or a combination of these factors. Those communities that fail to integrate are likely to remain reservoirs for resentment. (DCDC-GST-2040, NIC-GT-2025)

Urbanisation is also seen as an important trend. By 2040, around 65%, or 6 billion, of the world's population will live in urban areas, attracted by access to jobs, resources and security. The greatest increases in urbanisation will occur in Africa and Asia. As up to 2 billion people may live in slums, these areas are likely to become centres of criminality and disaffection and may also be focal points for extremist ideologies. Rapid urbanisation is likely to lead to an increased probability of urban, rather than rural, insurgency. (DCDC-GST-2040)

In addition, **megacities** are also highlighted as possible sources of conflicts as well as important future players. By 2030, the fifty greatest megacities in the world will concentrate more resources than most small and middle-income states, and they will demand more autonomy and exert greater power, even taking on a more prominent international role. Preserving humane living conditions in the world's megacities will be the major challenge facing some states. Cities will also absorb most national security resources. (ESPAS-GT-2030)

Trends in **innovation and technology** are also being examined especially in providing solutions to the major trends and challenges as those mentioned above. Technology will provide partial solutions for both adapting to, and mitigating the effects of, climate change. However, it is unlikely that, by 2040, technology will have produced low emission energy sources capable of providing the majority of the energy demanded. Nevertheless, advances in carbon capture technology are likely to be significant, allowing fossil fuel usage to continue in a limited emission regime, with particular expansion in the use of coal. Despite this, resource competition, carbon pricing, increased energy demand and the limitations imposed by climate change are likely to increase the cost of fossil fuels, stimulating the development of cleaner, renewable energy solutions and nuclear power. (DCDC-GST-2040) The pace of technological innovation will be key to solving such challenges. However, even with a favourable policy and funding environment for biofuels, clean coal, or hydrogen, the transition to new fuels will be slow. (NIC-GT-2025)

The most significant **innovations** are likely to involve sensors, electro-optics and materials. Application of nano-technologies, whether through materials or devices, will become pervasive and diverse, particularly in synthetic reproduction, novel power sources, and health care. Improvements in health care, for those who can afford it, are likely to significantly enhance longevity and quality of life. Advances in robotics, cognitive science coupled with powerful computing, sensors, energy efficiency and nano-technology will combine to produce rapid improvements in the capabilities of combat systems. (DCDC-GST-2040)

However, from a security perspective, technology will also facilitate the organisation of protests and high impact terrorist attacks. The future global environment will be defined by physical, social and virtual networks. The physical system will consist of complex interconnections, including extensive resource pipelines, communication cables, satellites and travel routes. The virtual networks will consist of communications servers linking individuals and objects, many of which will be networked through individual Internet Protocol (IP) addresses. Avenues for protest, and opportunities for new and old forms of crime, will emerge and may allow hostile groups to form and rapidly create effect. (DCDC-GST-2040)

In terms of **defence technologies** many states are likely to develop ballistic and cruise missiles capable of delivering CBRN weapons, as well as conventional payloads. Ballistic Missile Defence (BMD) and other air defence technologies may mitigate some of the risks. (DCDC-GST-2040) The majority of the technological breakthroughs are likely to be driven by the commercial sector, although technological adaptation in defence will continue at a rapid pace. Nonlethal, Directed Energy Weapons (DEW), space and cyber technologies will be available to a wide variety of actors, both state and non-state. (DCDC-GST-2040)

Finally, the growing demand is recognised for multilateral policies in the global and regional arenas for an increasing number of issues from the fight against climate change to disease control. There is, therefore, need for more multilateralism and, arguably, for a larger European role. (EU-GRASP)

SECURITY VISIONS, SCENARIOS AND FORECASTS

Visions are not that common in the security FLA.¹¹ There are only two cases expressing a shared vision of European security, i.e. FORESEC – although it is more in relation to the concept of security than a particular vision on how European security should develop – and a vision on integrated border management and critical infrastructure protection. (STRAW)

Scenarios in security FLA have a particular role. They are usually reflections of future states of the world in the event of particular threats or risks being materialised. Hence, there are scenarios about future regional conflicts; terrorism; WMD proliferation; energy security and climate change; severe human rights violations; migration. (EU-GRASP) Other examples include an earthquake inside or outside the EU; critical infrastructure failure: energy, telecom, ICT; terrorist action – CBRN; civil war; large-scale influx of refugees to EU. (ACRIMAS)

In the security FLA mapped there were hardly any forecasts in the classical sense, i.e. quantitative statements of the outcomes of particular events or trends in a specific time in the future. However, forecasts of a more qualitative nature were retrieved mainly from the studies examining global trends and the risk assessment studies. Naturally, these relate to some of the major trends presented in the previous section, although some of them are quite specific in examining the **nature of future conflicts**.

More specifically, state and non-state actors will seek to combine conventional, irregular and high-end asymmetric methods concurrently, often in the same time and space and across the combined domains of the air, land, sea, space and cyberspace. **Conflict** is likely to involve a range of transnational, state, group and individual participants who will operate at global and local levels. In some conflicts, there is likely to be concurrent inter-

¹¹ This section has been taken from the 2nd EFP Mapping Report (Amanatidou *et al*, 2012).

communal violence, terrorism, insurgency, pervasive criminality and widespread disorder. These forms of conflict will transcend conventional understanding of what equates to irregular and regular military activity. States will increasingly sponsor proxies, seeking to exploit gaps in the international system while minimising state-on-state risks. The range of threats will diversify, as technology and innovation opens up novel avenues of attack and adaptive adversaries exploit opportunities. (DCDC-GST-2040) **Terrorism** is unlikely to disappear by 2025, but its appeal could lessen if economic growth continues in the Middle East and youth unemployment is reduced. (NIC-GT-2025) The **CBRN threat** is likely to increase, facilitated by lowering of some entry barriers, dual purpose industrial facilities and the proliferation of technical knowledge and expertise. The likelihood of nuclear weapons usage will increase. (DCDC-GST-2040)

The incidence of **armed conflict** is likely to increase underpinned by an unstable transition to a multi-polar world that allows old and new state rivalries to emerge; widespread global inequality that heightens associated grievances; population increases, resource scarcity and the adverse effects of climate change that combine to increase instability; and the increased importance of ideology. (DCDC-GST-2040) Military operations are likely to continue to result in casualties and face the challenge of demonstrating legitimacy to sceptical public audiences. Influence activity, the battle of ideas, and perceptions of moral legitimacy will be important for success. Where instability affects national and multilateral interests, there is likely to be a requirement to provide support for legitimate governance structures and for stabilisation operations.

Associated to the nature of conflict was the issue of conflict governance. **Conflict governance** will require a multi-actor and multi-level approach. Multilateral military activity is likely to protect globalisation, including protection of global supply chains and space-based infrastructure. State interdependence will give most conflicts, wherever they occur, a global dimension. The changing balance of power is likely to deter military intervention by major powers outside their spheres of influence, without widespread multilateral agreement, which is likely to reduce the latitude for discretion. Persistent, complex problems will require the integration of all levers of state power, both across government and among partners and allies. (DCDC-GST-2040)

New alliances and partnerships will form and established ones will be adapted to meet the breadth and depth of the challenges. For European powers, the North Atlantic Treaty Organization (NATO) is likely to remain the defence organisation of choice. Competition for resources will increase the geostrategic importance of certain regions such as; the Asian Meridian, the wider Middle East and the Polar Regions. (DCDC-GST-2040)

At the same time **soft power** will be utilised in facilitating the achievement of political goals. All elements of power are likely to be used by a broader spectrum of actors and agencies, including organised criminal, terrorist and insurgent groups. Nonetheless, while traditional levers of power will continue to form the basis of statecraft, it is unlikely that the military instrument alone will be decisive. (DCDC-GST-2040)

As expected **demographics** is also another issue studied in global trends but from an interesting perspective examining the need for humanitarian intervention. Out to 2040, the demographic profiles of societies will change with the developing world accounting for the majority of population growth and representing 85% of the global total. However, limited economic development and cultural norms will persist, sustaining high fertility rates in regions such as sub-Saharan Africa, parts of the Middle East and Asia, and specifically in countries such as Afghanistan, Syria, Yemen and Pakistan. In contrast, Europe, Japan and eventually China and Latin America are likely to face the problems of an ageing and declining population. However, the long-term decline in fertility rates experienced by the most developed states is eventually likely to be halted, or even reversed, as societal norms change. (DCDC-GST-2040)

The role of **education** is also marked as the globalised economy becomes increasingly dependent on knowledge-based industries, creativity and innovation. Global access to education will remain variable, though, although ICT based initiatives are likely to improve basic skills in numeracy and literacy. This implies possible resentment as those who do become better educated may suffer frustration if they continue to experience inequality of opportunity based on their physical location, culture or language. (DCDC-GST-2040)

SECURITY WILD CARDS AND WEAK SIGNALS

Security FLA are particularly interested in wild cards. Several of the scenarios developed in the security FLA were representations of a future state of affairs in case a certain threat or risk is materialised. In this regard these scenarios can also be considered as wild cards even though they were not titled as such in the project documentations. Several wild cards and weak signals were further described in the 2nd Mapping Report. Here we will only list their headlines:

- Collapse of a Pivotal State.
- Cure for Ageing.
- New Energy Source.
- Collapse of Global Communications.
- External Influences (including major environmental disasters).
- Winners and Losers in a Post-Petroleum World.
- A Non-nuclear Korea?
- Potential Emergence of a Global Pandemic.

SECURITY MODELS AND ANALYTICAL FRAMEWORKS

It is remarkable that several security FLA either of the foresight or the assessment type contain a sophisticated model referring to conceptual or causal relationships. Thereby every project makes an important conceptual contribution to the scholarly debate in the security field, albeit with a concrete link to practical problems. Hence, the texts are a particularly fruitful source for further refinement and debate.¹²

More specifically the FLA mapped produced several conceptual frameworks to analyse the abuse of technology, to understand attitudes towards control of knowledge, to organise operations and to categorise certain trends and threats:

- *Framework to analyse the abuse of technology* - The framework distinguishes three types of the abuse of technology: technologies that enable misuse such as the internet; technologies that are harmful; and technologies that can harm unintentionally. (FESTOS)
- *Typology of attitudes towards the control of knowledge* – The typology distinguishes three groups of academics according to their attitude towards control and prevention of their work: ambivalent, control oriented and liberal. (FESTOS)
- *Operational Fields Matrix* - The matrix has two dimensions: level of action with the ends of Global vs. sub-state and the other being mandatory/coercive vs. voluntary measures. (FESTOS)
- *Taxonomy on Trends, Drivers, and Threats* - Taxonomy of threats consists of risk with its likelihood and impact. The latter two are increased or decreased by drivers and trends. Depending on the vulnerability the referent object will be damaged or hurt. (FORESEC)

Certain analytical frameworks were also developed such as the analytical model supported by STRAWiki. This is an active technology tool to monitor what is relevant in the security domain in terms of knowledge, experience and stakeholders, and deliver this information to the right audience at the right time. This is supported by a technology watch portal, a semantic search engine and an own wiki (STRAWiki). In addition, a common framework for the analysis of critical road infrastructure objects (bridges/tunnels) or road transport networks was developed with regards to their importance within the European transport network. (STAR-TRANS, SERON)

A generic system architecture was developed with relevant functionalities for hazard identification to model the energy networks. (EURACOM) The architecture framework is based on the enterprise architecture paradigm, however primarily used as descriptive framework, describing the European energy environment.

¹² For a more detailed EFP WP2 results, see 2nd EFP Mapping Report (2012).

SECURITY KEY AND EMERGING TECHNOLOGIES

One might expect that key technologies would be a major outcome in security FLA drawing on the experience from more traditional security FLA originating in the defence sector (e.g. Ministries of Defence, defence think tanks). However, this is not the case in the security FLA mapped as only two resulted in lists of future emerging technologies. This fact can be explained by the different nature of FLA mapped with the importance attributed to the engagement of a broad variety of stakeholders and the different national perspectives that come to play in many EC FP funded projects.¹³

The following list include some examples of emerging technologies and potential threats considered in the FESTOS project:

- *Cyborg insects and swarm robotics* – Swarm robotics is a novel approach to the coordination of a large number of robots, inspired mainly by insects, which show how large numbers of simple individuals interact to create collectively intelligent systems. Researchers envision that robots will be mass-produced and programmed for various tasks such as surveillance, micro-manufacturing, cleaning or medicine.
- *Internet of things and ambient intelligence* – 'Internet of Things' (IoT) means a network of everyday objects such as food items, home appliances, clothing as well as various sensors that will be addressable and controllable via the Internet. IoT is related to the vision of Ambient Intelligence where people are surrounded by interconnected devices that are embedded in their surroundings and easily accessed via intuitive interfaces. Computers are everywhere but recede to the background, being invisible and seamlessly responding to the needs of individuals.
- *Molecular manufacturing* – Materials that can be programmed to be self-assemble, after their shape and physical properties to perform a desired function and then disassemble after use or in response to user input or autonomous sensing. Known also as 'claytronics' or 'infochemistry' this emerging technology field combines theory of information, chemistry and programmability to build information into matter.
- *Metamaterials; Invisibility Cloaking* – Nano-structured materials with negative refractive index. Can make objects invisible or appear as other objects.
- *Smart phone mash-up* – Smart phones that are combined with new features such as GPS receivers, cameras and internet connectivity and can interact together or with internet services providing new functions for surveillance, data processing, observation or control, making a mobile phone an extremely potent device.

¹³ For a more detailed EFP WP2 results, see 2nd EFP Mapping Report (2012).

SECURITY PATHWAYS AND ROADMAPS

On a similar note, the security FLA mapped did not result in specific pathways and (technology) roadmaps as one might expect. There was only one case (ACRIMAS) that developed a roadmap for an upcoming demonstration project within the area of crisis management as the Phase II of the ACRIMAS project. This roadmap would elaborate a systematic development process for crisis management systems, procedures and technologies in Europe, to be implemented within the demonstration project. The process aims for gradual evolvement of crisis management capabilities through demonstration and experimentation activities, transfer of related knowledge between stakeholders and by promoting an environment for co-development of crisis management technology and methodology where users, providers and researchers work together.

Overall, the **main outcomes of the ‘anticipating phase’** of the mapped FLA fall into the groups of trends, challenges, scenarios, and models rather than key technologies or roadmaps. The result is hardly a surprise given the aforementioned aims and rationales that emphasised the transformation of existing paradigms and the engagement of stakeholders and decision-shapers.

Recommending security futures

The 2nd EFP Mapping Report offers a detailed discussion about several outcomes from the ‘recommending’ phase of Security FLA. This section highlights some key results.

Recommendations from FLA may fall into the following categories: Policies and actions; Initiatives and actors; Appropriation and dissemination; Investments and training; Alliances and synergies; (FHS) research. Based on the analysis of the security FLA mapped almost all projects¹⁴ focus in their recommendations on policy action and on future research. The policy recommendations usually address the primary target audience according to the scope and territorial coverage of FLA, i.e. policy-makers at national but mainly EU or international level. They may also correspond to the specific scenarios developed like in the following four recommendations from SANDERA:

- *Policy for scenario “Indifference”* – Enhance strategic policy intelligence capacity in order to move towards a world of “indifference” between ERA and defence research and innovation in 2030. Even if the two policy domains (research and security) remain largely indifferent to each other, policy makers in both fields should carefully observe the developments in the respective other domain. ERA and defence policy makers should install an “early warning system” of change in this area and the consequences this might entail for ERA.

¹⁴ This excludes the assessment FLA which usually produce “anticipating futures” types of outcomes and do not go further into the “recommending futures” types of outcomes.

- *Policy for scenario “Integration”* – Develop a shared vision and set common goals in order to move towards a world of "INTEGRATION" in 2030. In a first step, this discourse should focus on the European level and involve all relevant European agencies and initiatives (EDA, ESA, FRONTEX, EUROPOL, EUROJUST), the Commission (DG Research, High Representative for Security) and representatives from the Council Secretariat and the Council itself.
- *Policy for scenario “Cooperation”* – Deepen the existing dialogue. There are a number of potential governance frameworks for cooperation such as ad hoc cooperation between ERA agencies and national bodies, or an institutional framework for cooperation based on an ESRI-like approach. In this effort the common areas of interests should be identified while the differences in the rules governing civil and defence research should be mitigated.
- *Policy for scenario “Competition”* – Develop policy goals based on the principles of human security in order to move towards a world of "COMPETITION" in 2030. The EU would deliberately abstain from any role in the defence research field and instead stress the civilian character of the Union’s science and technology policy.

PATS policy alternatives to promote privacy accountability and privacy branding practices include incentives (top-down developed by governments or bottom-up developed by NGOs for example), regulations and self-regulation alternatives, and influencing the adoption of privacy branding. PATS also produced preliminary recommendations on how to promote privacy accountability and branding among security organizations in the countries covered by the study. In addition recommendations are produced to promote privacy accountability and branding practices at the European level in combination with the General Data Protection Regulation which may serve as a guideline for the security industry for co-regulation and privacy branding.

Other types of recommendations are more holistic in nature but still keep the security perspective at their core while addressing a number of grand challenges like in the field of energy, the environment or migration. This is the case of FORESEC, EU-GRASP or the NATO study (Security Jam, 2012) for example.

FORESEC recommends:¹⁵

- To develop an EU energy security strategy.
- To reduce emissions and protect the environment.
- To deal with security aspects of migration and changing demographic patterns.
- To promote dialogue with the security and intelligence services across the EU.
- To increase public awareness of environmental risks.
- To reduce vulnerability of critical infrastructure.

¹⁵ For a more detailed description of FORESEC recommendations, see 2nd EFP Mapping Report (2012).

EU-GRASP places special emphasis in the role of the EU in a multi-polar world. The EU must adapt to changing global multilateralism. The EU must be steady in its promotion of multilateralism as an ideal, but extremely flexible in its multilateral practice, and find ways – for which EU governance seems particularly well fitted compared to the traditional diplomacies – to engage with legitimate sub-national, multinational and transnational non-state actors and their networks. At the same time, it must find innovative ways to address the problems of absent, competing, obsolete or ineffective multilateral structures that exist both at the regional and global level. The EU institutions must be flexible enough to work with other institutional structures or simply to create alliances with groups of countries that are promoting multilateral solutions in their regions and on the global scale, such as those of Latin America and of Africa. The “sui generis” character of the EU is strength in global multilateralism, and should not be abandoned lightly. The EU must expend more effort using the combined capabilities of the EU institutions and of EU national diplomacies to convince third parties, and less time negotiating amongst EU member states. The EU is more successful in global multilateralism when it has a unified voice; the best way of ensuring this simple voice is often, but not always, to occupy a single, EU chair. At the same time coherence is a crucial value for success in the mid- to long term, and the best way to ensure it is to apply uniformly the principles and values of the EU.

In its recommendations, the NATO study (Security Jam 2012) focuses, among others, on security issues of global concern, managing relations with emerging powers as well as on the EU defence research.

- A maritime domain policy for NATO - NATO should formalize a maritime domain policy that anticipates ships operating beyond the Euro-Atlantic area more regularly, to map out member state programmes and to push for new common platforms.
- A NATO-China Council - In light of China’s increasing global influence and clear military build-up, NATO should establish a NATO-China Council (NCC) to mirror the alliance’s engagement within the NATO-Russia Council. Such a platform would help establish stronger diplomatic and personal connections with Chinese counterparts both within the Alliance and at national level.
- Update of EU’s Defence Industrial Policy - The EU’s Defence Industrial Policy should be updated, with a focus on pooling R&D, restricting sensitive exports and developing a new generation of military equipment.
- 'Smart Defence Mindset' for NATO - NATO should launch a programme dedicated to fostering a 'Smart Defence Mindset' amongst military personnel, national politicians and other stakeholders.

For additional security recommendations, see 2nd EFP Mapping Report (2012).

Transforming security futures

‘Transforming futures’ refers to the ability of FLA to shape a range of possible futures through six major types of transformations representing the ultimate outcomes or impacts of FLA:

- Transforming capacities and skills
- Transforming priorities and strategies
- Transforming paradigms and current visions
- Transforming socio-economic and STI systems
- Transforming behaviour, attitudes and lifestyles
- Transforming knowledge-based products and services

These types of impacts need significant time after the end of the FLA to be identifiable and their identification necessitate impact assessment exercises which are beyond the scope of the EFP project. In this regard, the present section reports examples of recommendations (that would be grouped under the ‘recommending futures’) that may lead to transformation such as the above rather than any actual impacts.

If its recommendations are taken-up, EURACOM may transform capacities and skills as well as knowledge-based services in relation to risk assessment and contingency planning in all the energy sectors: from fuel transport, electricity generation (nuclear and fossil fuel plants), over electricity transmission, oil and gas pipelines, up to fuel storage (nuclear fuel, nuclear waste, oil, and gasification plants). EURACOM’s ultimate aim is to strengthen the common understanding of threats, the establishment of common procedures and understanding of risks, developing effective and coherent tools for planning contingency measures.

EURACOM may also transform current national and European policies and strategies by proposing suggestions and options to support European policies for the protection of critical energy infrastructures. By bringing together all sectoral stakeholders (production, transmission and distribution) and the Member States authorities EURACOM may also contribute to transforming STI systems with the development of more secure, integrated frameworks, and the implementation of emergency plans, based on a holistic approach with European guidelines, new norms and standards.

SECURENV may also transform policies and strategies by supporting the development of policies, programmes and initiatives with providing advice for policy makers, programme managers and researchers dealing with security and environmental issues. SECURENV might have also contributed to transforming priorities for European research as the project defined a strategic roadmap for future security research. The SANDERA project may also contribute to transforming policies and strategies through

the policy analysis toolkit that enables the assessment of policy proposal in the light of the ERA-defence research and innovation relationships.

FESTOS may contribute to transforming capacities and skills, behaviour, attitudes and lifestyles as well as knowledge-based products and services. It suggests certain measures in relation to the control of knowledge, the education of citizens, scientists and engineers, and different types of codes of conduct as possible measures to treat the problematic issue of the dark side of technology. Common to these three groups of measures is the fact that they try to approach the development of potentially dangerous knowledge on the level of the individual scientist, researcher or engineer who is involved in the development of new technologies or its applications.

FESTOS may also transform current security priorities and strategies with a set of measures aiming at structural changes in security and technology policies. One possible measure in this regard is Security Impact Analysis (SIA). SIA could be extended from the national level to cover the global, European, research and enterprise levels. Another dimension of policy measures to cope with potential emerging threats should be R&D programmes promoting responsible research which increase the knowledge needed around certain possible threats. Several themes that could be possibly included in national and/or European programs include foresight and scenario methodologies; knowledge control; ethics and freedom of science; technology and research on ICT, nanotechnology and new materials; biotechnology; robotics; cognition and converging technologies.

FESTOS also contributes to transforming STI systems. It is highlighted that there is a need to involve existing institutions in the Member States and in European Union occupied with early warning in to the process. In this regard the project examines two types of institutes: an imaginary Committee for Threat Assessment and another institute to be created based on the already existing Situation Centres that occur on local, national and regional level.

HEALTH FUTURES: MAPPING OF 20 HEALTH FLA CASES

The 3rd EFP Mapping Report analysed 20 FLA cases. Table 2 shows some basic information about the selected cases: project title, short name, coordinating country and type of FLA.

Geographically speaking, the mapped cases mainly derive from high income sovereign areas or global infrastructure entities (e.g. WHO), consultancies and voluntary associations with global reach (e.g. Economist Intelligence Unit EIU and the World Economic Forum). All encompass national, transnational and global scope but the selection leans towards cases and implicit outputs for the EU.

Table 2: Health FLA cases analysed in the 3rd EFP Mapping Report

Project Title	Short name	Coord. Country	Type of FLA
1. The Future of Healthcare in Africa		EIU report	Forecasting
2. 2009 Ageing Report		EPC/EU report	
3. European Economy: Healthcare expenditure projections		EPC/EU report	
4. The future of healthcare in Europe		EIU report	
5. Stimulation of crisis management activities	SICMA	IT	Foresight
6. Nurse Forecasting: HR Planning in Nursing	RN4CAST	BE	
7. The Detection and Identification of Infectious Diseases	DIID	UK	
8. The Ageing Society 2030		DK	
9. The Future of Pensions and Healthcare in a rapidly ageing world		WEF	
10. Tackling Obesities: Future choices	Obesity	UK	
11. Mental Capital and Wellbeing	Mental Capital	UK	
12. Developing the framework for an epidemic forecast infrastructure	EPI WORK	IT	
13. Harmonizing, Integrating, Vitalizing Research on HIV/AIDS	HIVERA	FR	
14. Scanning for emerging science & technology Issues		EU	
15. Horizon Scanning of Medical Technologies		AUS/NZ	
16. CfWI Public Health Skills and Workforce	CfWI-HS-PH	UK	Impact assessment
17. Child well-being in the UK, Spain & Sweden		UK UNICEF	
18. Human Health: Climate Change 2007		IPCC	
19. Health in the Green Economy: Transport		WHO	
20. Health & the environment: a compilation of evidence		AUS	

AIMS AND OBJECTIVES

The health theme of the EC FP7 aims at improving the health of European citizens and boosting the competitiveness of health-related industries and businesses, and at the same time addressing global health issues. Within this overall aim, priority is given to the following research areas:

- *biotechnology, generic tools and medical technologies for human health* (detection, diagnosis and monitoring, prediction of suitability, safety and efficacy of therapies, innovative therapeutic approaches and interventions);
- *translational research for human health* (integration of biological data and processes, research on the brain and related diseases, human development and ageing, research on infectious diseases, research on major diseases: cancer, cardiovascular disease, diabetes/obesity, rare diseases, other chronic diseases); and
- *optimising the delivery of health care to EU citizens* (translation of clinical outcome into clinical practice, e.g. better use of medicines, quality, efficiency and solidarity of health care systems, enhanced health promotion and disease prevention).¹⁶

Although the research themes follow the EC FP7 definition, the mapped FLA are not, as noted above, limited to EC sponsorship. They also include national, other European and international entities including privately commissioned reports by Janssen Pharma. The theme specific health related FLA, abide by the rule that the most common aims are to ‘transform strategies and priorities’, ‘paradigms and current visions’. This may reflect an historical trend to move away from viewing health systems as sickness systems towards systems for preventing illness and maintaining good health. These latter systems are possible because of game changing health technologies, innovative medicines and new approaches in diagnostics. However as the selected FLA indicate, discontinuities and gaps in policy visions, financial capacities and commitments may represent significant future hindrances.

There is a focus on common activities and shared ways of doing things, which reflect the trans-national and global reach of human health issues: this is accompanied by some movement towards improving capacities, skills and importantly, end user services provided. The DIID project (Detection and Identification of Infectious Diseases) for example aimed at producing a vision on managing threats of infectious diseases in humans, animals and plants over the next 10-25 years through special systems for detection, identification and monitoring. EPIWORK aimed at developing an open, data driven, computational modelling platform to be used in epidemic research as well as in policy making for the analysis of global epidemics, integrating and leveraging on transnational data, and to develop, and validate an Internet-based Monitoring System (IMS) producing real time data on disease incidence and epidemic spreading.

¹⁶ See ftp://ftp.cordis.europa.eu/pub/ftp7/docs/health-research_leaflet_en.pdf last accessed 16 December 2012.

RATIONALES

The mapped health FLA are underpinned by an orientation towards policy and strategy development. There seems to be relatively high importance weighted towards 'forecasting TEEPSE events and developments' and 'recognising drivers/impacts of TEEPSE changes' as well as towards 'identifying TEEPSE issues', and 'risks, grand challenges and opportunities'. This may be explained by the application of quantitative models in several of the cases. All the health FLA have similar rationales apart from EPIWORK. Interestingly however, relative low importance has been attached to harmonising supply and demand needs. This is surprising in view of fiscal shocks and the subsequent relative decline implied for investing in capacity. The identification of issues, risks, and opportunities partly reflects the main orientation of the assessment as well as forecasting studies in the health area.

Another interesting finding is that although health care, disease transmission, remedies and the like are to a very large degree increasingly boundaryless and require transnational and global approaches, 'networking and international cooperation' is not as significant in the health-related FLA as might be expected.

Anticipating health futures

The 3rd EFP Mapping Report offers a detailed discussion about several outcomes from the 'anticipating' phase of Health FLA. This section highlights some key results.

HEALTH DRIVERS, TRENDS, MEGATRENDS AND GRAND CHALLENGES

There is no clear differentiation between drivers, trends and megatrends or grand challenges – indeed issues segue into and onto each other but some proximal observations can be made as to significance for the EU.

If we first look at drivers specifically defined within the FLA, **demographic shift (in terms of ageing)** is generally located as a most significant driver and one like **climate change**, perceived as highly resistant to remediation in the short or medium time frames.

Demography issues are well exercised in the health arena because of implications of rising costs for managing **multiple chronic conditions** (a feature of longevity and life style), rising **dependency rates** and the use of costly **medical technology**.

Life expectancy is projected to grow over the next few decades: by 2071 the number of adults over 65 could double to nearly 21.3 million, and those over 80 could more than treble to 9.5 million. According to the World Bank public expenditure on healthcare in the EU could jump from 8% of GDP in 2000 to 14% in 2030 as **healthcare costs** are rising faster than levels of available funding. The rising numbers of older people means consequent shrinkage in labour markets, implying declines in productivity and growth and also creating possible inter- generational tensions within societies around issues of rationing expensive healthcare.

Of course, increasing longevity means attitudes towards retirement are shifting both socially and politically and are heavily dependent on economic circumstances. Attitudes towards retirement govern both length of labour participation (people may want and are able to work very much longer than previously) and savings behaviour. Current expectations regarding pensions and healthcare provision may not be met, and this may influence retirement and healthcare burdens on **public and informal care systems** requiring significant changes in how policy is devised and framed.

Healthcare innovation and **regulation** have been placed as important drivers in healthcare evolution. DataMonitor (2007) predicts a number of new products will reach the market in the orthopedic, oncology and cardiology sectors due to significant increases in R&D spending. Biotechnology, nanotechnology and gene therapy offer the potential for significant but costly advances in both life extension and improved quality of life. Telemedicine is viewed as offering capacity for widespread homebased healthcare if appropriate operating infrastructures emerge. The extent and impact of

new health technologies over the next 25 years is highly uncertain, as is the regulatory frameworks (including IP) that surround them. Medical innovation partly creates its own demand (e.g. due to health-seeking behaviour) and thereby raises medical expenses. Medical innovation may further increase life expectancy, so increasing the need for old-age social security. New IP regimes would affect pharmaceutical companies, drug regulations and healthcare provision. (Future of Pensions & Healthcare WEF)

Epidemiological evidence indicates changing patterns in **infectious & chronic disease** and these patterns are seen as drivers affecting healthcare. The combinatory effects of these patterns with **climate change** and weather weirding are presented as drivers but the rate and extent of impacts is highly uncertain as is the effectiveness of human responses. The 2003 heat wave in Europe claimed the lives of 35,000 people; the top 10 warmest years over the last century have all occurred since 1990. Less rain and warmer temperatures from climate change could reduce agricultural yields by one-third or more in the US grain belt, and in vast areas of Asia and much of Australia. (Future of Pensions & Healthcare, WEF) New patterns of heat waves and cold snaps, floods and droughts, and local pollution and allergens will affect health directly.

Other drivers are identified such as increasing travel, migration and trade; exotics; drug use leading to drug-resistant organisms; poverty and conflicts in Africa; changing patterns of land use in Africa; shifting agricultural practices towards intensification in Africa; implementation of international systems of disease surveillance and control; lack of new pesticides for crops, and of drugs and vaccines for animals. (DIID) Apart from demographic age-shift MENTAL CAPITAL noted changes in the global economy and the world of work; the changing nature of UK society; the changing nature of public services; and new science and technology. As drivers affecting obesity trends were identified like urbanisation, and continued car use; the personalised services in health and education; the regulation in the UK and EU; the threat of litigation; ICT and teleworking, Genotyping; GM acceptability; the important role of food and pharma companies; nanotechnology; discrimination; sedentary lifestyles; more eating out; rising costs of healthcare; large retailers dominating food supply chain; growth of functional foods and food/pharmaceutical profit pushing consumption. (OBESITY)

Ageing, longevity and the rise of **chronic multiple illness** are also evidentially located as trends as well as being drivers. Eurostat figures show that life expectancy for male babies born in 2030 is more than a decade higher than that for those born in 1980 in the EU-15 (generally the wealthier member states). While higher life expectancy is good news, there is a downside: older people are more likely to be prey to chronic disease. In 2010, over one-third of Europe's population is estimated to have developed at least one chronic disease. The increasing likelihood of developing chronic disease later in life translates into higher healthcare costs. If poorly managed, chronic diseases can currently account for as much as 70% of health expenditure, partly because of the

significant costs involved in hiring a workforce to care for sick older people. Exacerbating the problem is the fact that the burden of paying for care will fall on a shrinking labour market cohort of younger people. For the EU as a whole, life expectancy at birth for men would increase by 8.5 years over the projection period, from 76 years in 2008 to 84.5 in 2060. For women, life expectancy at birth would increase by 6.9 years, from 82.1 in 2008 to 89 in 2060, implying a narrowing gap in life expectancy between men and women. The largest increases in life expectancy at birth would take place in the most recent EU Member States, according to the assumptions. It is assumed that some catching-up will take place, with increases in life expectancy of more than 10 years over the projection period – a bigger increase than in the rest of the EU. Overall however, life expectancy at birth is projected to remain below the EU average in all new Member States – except in Cyprus – throughout the projection period, especially for men. For life expectancy at birth for men, it would narrow from 13.1 years in 2008 to 5 years in 2060. For women, the reduction in the differential is smaller, from 7.7 years in 2008 (84.3 in France to 76.6 in Romania) to 4.1 years in 2060 (90.1 in France to 86.5 in Bulgaria). Life expectancy at the age of 65 would increase by 5.4 years for men and by 5.2 years for women over the projection period, for the EU as a whole. In 2060, life expectancy at age 65 would reach 21.8 years for men and 25.1 for women. Most children today would live into their 80s and 90s. (2009 Ageing Report)

Disease prevention and **life-style changes** emerge as trends in health behaviour: more effective preventive measures and fundamental lifestyle changes will be promoted to encourage healthy behaviour. The World Health Organisation (WHO) noted in 2005 that at least 80% of all cases of heart disease, stroke and diabetes are preventable. This requires lifestyle changes, which can be influenced through a combination of public education, pricing, taxation and various incentives and disincentives. However expenditure on prevention remains low in many countries compared with the sums spent on curative care. As awareness of the importance of prevention takes hold over the next two decades, however, the proportion of expenditure on public healthcare may rise. (Future of Healthcare in Europe)

Demands for increased transparency of **health intelligence** and effective **data governance** emerge as trends. European governments will need to find ways to improve collection and transparency of health data in order to prioritise investment decisions. There are strong indications that governments have only vague ideas as to whether the investments they make in healthcare are valuable. Sound analysis of return on investment is becoming increasingly important, as demand rises and funds become scarce. Part of the reason why the analysis is lacking is that clinical data are opaque, owing to requirements to preserve the privacy of personal medical records. Legislation such as the 1995 Data Protection Directive will need to be reviewed with a view to

improving the collection and transparency of medical data, to enable more informed healthcare investments. (Future of Healthcare in Europe)

Low fertility rates emerge as a continuing trend for the EU, (from 1.52 births per woman in 2008 to 1.57 by 2030 and 1.64 by 2060). In the euro area, a similar low increase is assumed, from 1.55 in 2008 to 1.66 in 2060. In all countries, the fertility rate would remain below the natural replacement rate of 2.1 births per woman that is needed in order for each generation to replace itself. This will result in slow growth and in most cases actual declines in the population of working-age. The fertility rate is projected to increase in all Member States, except in the few where total fertility rates are currently above 1.8, namely France, Ireland, Sweden, Denmark, the UK and Finland, where it is assumed to decrease but remain above 1.85, or remain stable. The largest increases in fertility rates are assumed to take place in Slovakia, Poland and Lithuania, which had the lowest rates in the EU in 2008; here, the increase would occur gradually, approaching the current EU average rates only in 2060. (2009 Ageing Report)

Interestingly the trend identified of inward net **migration** into the EU already low will slow even more. For the next few decades annual net inflows to the EU are assumed to total 59 million people, of which the bulk (46.2 million) would be concentrated in the euro area. The trend is assumed to decelerate over the period, falling from about 0.33% of the EU population to 0.16% in 2060. In many Member States, the size of net migration determines whether the population still grows or has entered a stage of decline. A zero migration population scenario shows how the labour force (aged 15 to 64) would gradually fall behind the level in the baseline scenario in the absence of net migration: by 2030, the labour force would be 10% lower and 20% lower in 2060. Making the best use of the global labour supply through net migration will be increasingly important and requires ensuring that immigrants are effectively integrated into the EU's economy and society. Net migration flows are assumed to be concentrated in a few destination countries: Italy (12 million cumulated to 2060), Spain (11.6 million), Germany (8.2 million), and the UK (7.8 million). According to the assumptions, the change of Spain and Italy from origin to destination countries is confirmed in coming decades. Estonia, Lithuania, Latvia, Poland, Bulgaria and Romania, which are currently experiencing a net outflow, would see it taper off or reverse in the coming decades. However fiscal shocks, economic stagnation and significant political pressures are major factors in determining migrations trends. Slowdowns in migration flows, which have been sourced for cheap health and social care capacity requirements, will impact on service delivery in these areas. (2009 Ageing Report)

The **Grand Challenges** which emerge from the selected FLA and are facing the EU flow from the drivers and trends. For example how will significant pressure on pay-as-you-go (PAYG) public pensions and healthcare systems be relieved, due to rapid population ageing, cost-increasing medical technologies and higher incidences of chronic diseases. China, for example, and this may affect EU trading capacity here, will be confronted with a significant increase in old-age social security expenditures over the next few decades. World Bank (2005) projections for China, based on existing pension provisions and a no coverage expansion scenario, show China's implicit pension debt (i.e. the present value of projected accrued liabilities) amounts to approximately US\$ 1.6 trillion. (Health Expenditure Projections) As governments continue to struggle with rising pension and healthcare costs, further political reforms and a growing role for the private sector are likely to emerge as serious challenges requiring resolution. . Pressure on employers to fund and facilitate healthcare for their employees will increase. A better understanding of savings and investment alternatives becomes increasingly important due to the shift towards greater individual responsibility and personal choice in defined-contribution retirement schemes, especially in high income countries.

A major challenge identified at global and sovereign levels is the structural shortage of well-trained medical and healthcare workers. According to the WHO (2006), a global deficit of 2.4 million doctors, nurses and midwives exists. Currently 57 countries, primarily in low income countries, face critical shortages of healthcare workers. (RN4CAST) Old-age care is especially in need of more trained, and adaptable personnel. This latter area points to challenges as to the **future role of the individual** as evidence indicates the **diminishing role of the family in old-age social security**. In many low income countries and some high income countries, families traditionally have played an important role in supporting ageing populations. The tradition is that every individual will support his/her parents in old age, and in turn will be able to rely on the financial support of his/her children. This tradition is codified in law in some countries (e.g. children have the legal obligation to support their parents in China and Singapore). However, this social convention is being challenged as many young people migrate to cities, family sizes shrink and people adopt more individualistic attitudes.

The agglomerated picture that emerges for the EU is a landscape of rising health costs engendered by ageing populations and the related rise in chronic disease, costly technological advances, delivery and financing structures that are inadequate for contemporaneous requirements. Underpinning this landscape are perceived radical changes in attitudes to individual and group community responsibilities that will impact on policy determinations.

HEALTH VISIONS, SCENARIOS AND FORECASTS

The mapped health related FLA show widespread use of visions, scenarios and forecasts with demographic shifts, rising healthcare costs, and emerging technologies predominating. Scenarios are ubiquitous in health FLA as is the use of forecasting. Many combine statistical forecasting with perceived trends to develop future scenarios that could form the basis for discussions for future policy formulations and options (Future of Healthcare in Africa). Many also commence from a vision (s) normatively determined on previous trends and future expectations to foresight and forecast future requirements in research, policy development, resources prioritisation and interactive stakeholder engagement.

The Ageing Society 2030 (Denmark) is a good example of this approach. Here the starting point is a vision of the development of an age-integrated society in which individuals' roles in society are not determined by their chronological age, but rather by their physical and psychological functional ability. The normative basis for the vision is anticipated growth in the number of people over the age of 60-65, resulting from previous trends in the birth rate, the continued relatively low rate of fertility and the anticipated increase in average life expectancy. This will mean that the workforce will become smaller, the increase in average life expectancy will mean that the individual will spend an increasingly greater proportion of his/her adult life outside the labour market but where financial and social structures have not kept up with the increase in life expectancy and the improvement of functional abilities and needs adaptation. The project then recommends (although described as forecasts in the mapping exercise they might better be seen as recommendation) the need for greater focus on the preconditions for creating an age-integrated society concentrating on the determinants for an active and healthy life, functional ability in its broadest sense, the technological opportunities for maintaining functional ability for as long as possible, the organization of the labour market and of companies, and social cohesion in terms of culture, society, gender and ethnicity and across the generations.

Assumed technology advances appear a key determinant in many scenarios – in making telemedicine ubiquitous, for example (The Future of Healthcare in Africa). In this scenario, technology will be the dominant means of extending access to healthcare across the continent, enabling every citizen to access both basic and more specialist healthcare by 2022 even in the most rural parts of Africa. This process will build on the mobile applications rolled out a decade earlier that reminded patients to attend clinic appointments or to take medicine. By 2022 the use of nanotechnology to create diagnostics tools for individuals and health extension workers in the field will be routine. Platforms that use SMS to link with voice messages will provide additional support, and most rural health workers will use SIRI, a speech recognition “personal assistant” that will allow them to schedule appointments, record patient data and information and

include low-cost diagnostics applications. Partnerships between the Mobile Health Alliance and UNICEF will help to tie in telemedicine platforms with child protection and other elements of social protection, thereby creating a seamless social service safety net. Local clinics and health workers will have the services of remote general practitioners and specialists accessible 24 hours a day. Video-conferencing will allow doctors to treat patients remotely, and wireless applications for mobile-phone platforms will enable reliable data collection.

DIID (UK) offers a specific vision of step changing infection detection systems in 10–20 years integrated into wider systems for disease management. A case example is offered of a self-diagnostic device for sexually transmitted diseases by 2015 saving the National Health Service around £135 million per year for the treatment of infections of chlamydia and gonorrhoea alone. The early detection and treatment is forecast to reduce the spread of disease and reduce the risk of complications due to otherwise untreated infections – creating future cost savings. The key choices for policy makers and disease-management professionals include governance issues (different forms and new regulations), how to exploit the existing technology for future systems, how to obtain the best public value from future systems, how to support science areas that are key enablers for future systems, and the need to ensure public engagement with the design of such systems if they are to be effectively deployed.

The WEF report (Future of Pensions and Healthcare) uses 3 global scenarios for 2030 (briefly outlined below) as a basis for challenging current thinking and to facilitate debate between key decision-makers for future action. New forms of collaboration between key stakeholders – individuals, financial institutions, healthcare providers, employers and governments – are determined as critical to finance the ongoing well-being of current and future generations in a sustainable manner.

The Winners and the Rest: This is a world in which high global growth delays the financial consequences of the growing demographic crisis. Despite growing liabilities from ageing populations, most governments are able to maintain scaled-back versions of existing social security systems, which they do as a matter of political expediency.

We Are in This Together: This is a world distinguished by a concerted effort on behalf of leaders and electorates to rein in growing inequality and reassert the idea of collective responsibility and accountability for social services.

You Are on Your Own: This is a world in which an economic recession is prolonged in the early 2010s, causing fiscal difficulties for most state-funded pension and health systems. Individual responsibility is forced upon many people by the failure of existing social security systems under extreme financial pressure.

These scenarios are based on two critical determinants - the path of economic growth between today and 2030, which could and probably will vary considerably and the second on putative social and political attitudes towards responsibility for the provision and financing of social services. The scenarios are then examined for future effect in the cases of China and Italy considering the demographic shifts, challenges to be met and driving forces specific to those societies.

Forecasting is used extensively in a number of FLA. The IPCC (Human Health: Climate Change – 2007) forecasts that climate change will have effects on human health based on observed trends, statistical modelling and legacy data. These observations include among many the global burden of disease, wider dispersion of a range of infectious diseases, degradation in urban air quality and variabilities in crop yields. Increases in the frequency or intensity of heat waves will increase the risk of mortality and morbidity, principally in older age groups and among the urban poor. The associated health impacts of climate change are substantial, including changes in climate variability that would affect many vector-borne infections. Populations at the margins of the current distribution of diseases might be particularly affected. Climate change represents an additional pressure on the security of the world's food supply system and is expected to increase yields at higher latitudes and decrease yields at lower latitudes. Further assuming that current emission levels continue, air quality in many large urban areas will deteriorate. Increases in exposure to ozone and other air pollutants (e.g., particulates) could increase morbidity and mortality.

The FLA, European Economy: Healthcare Expenditure Projections offers a range of forecasts. Included are labour force assumptions (echoing the Danish study but at an EU level) that labour force participation rates would increase but labour supply will decline because of future population trends. For the EU as a whole, the participation rate (of people aged 15 to 64) is projected to increase by 3.5 percentage points, from 70.6% in 2007 to 74.1% in 2060. The labour force in the EU would increase by 3.7% between 2007 and 2020. This is mainly due to the rise in the labour supply of women. However, the positive trend in female labour supply is projected to reverse after 2020 and, as the male labour supply drops too, the overall labour force is expected to decrease by as much as 13.6%, equivalent to around 33 million people. According to the assumptions, the unemployment rate would be reduced slightly, the employment rate would increase but the number of workers would shrink. Overall, a reduction in the EU unemployment rate of around 1 ½ percentage points is assumed. The employment rate (of people aged 15 to 64) in the EU would increase from 65.5% in 2007 to 66.6% in 2010, 69% in 2020, and almost 70% in 2060. However, the number of people employed would record an annual growth rate of only 0.4% until 2020, before reversing to a negative annual growth rate of a similar magnitude until 2060. Labour input (hours of work) is projected to decline. It would increase by 5.4% until 2020 and fall by 12.9% till 2060. The ratio of elderly non-workers to workers will rise steeply.

Visions, scenarios, forecasts are in all regards preoccupied with issues of demographic trends, rising healthcare costs in order to finance those shifts, the inadequacies of healthcare structures in high and low income countries in delivering services often through lack of skilled personnel combined with the serendipitous effects of climate change, the widening epidemiology of chronic and infectious diseases and perceived changes in social attitudes to caring in communities. In many of the FLA scenario and forecasting approaches are viewed as part of management or policy-making toolkits to improve organisational performance and learning.

HEALTH WILD CARDS AND WEAK SIGNALS

Few health related FLA include analysis or explicit reference to wild cards or weak signals. One study mapped (SESTI) however, analysed certain weak signals in the area of health (among others). This study posited that societal developments are often influenced by improbable events with high impact. These events are preceded by “weak signals” which are only partially discussed in policy, if at all, and rarely acted upon. The increasing complexity and uncertainty is reflected in the growing demand for tools for anticipatory intelligence, such as scenario analyses, Delphi, modelling and simulation tools. The study indicated that several countries, Finland, United Kingdom and the Netherlands, have initiated horizon scanning projects to identify disruptive events that are not on the radar of policy yet. The overall goal of the project was to contribute to the development of an effective system for the early identification of weak signals of emerging issues. For that a weak signals pool, integrating several scanning tools in a wiki to collect and disseminate the information, has been set-up. Additional to its European focus, potential links with national actors and platforms are planned, making use of existing networks such as ForSociety, to feed the project outputs into European and national policy processes. Beneath this overriding goal is the desire to initiate momentum at national and European level to pro-actively address emerging issues. Next to its practical goals, this project also aimed at developing and improving new tools and methods for weak signals of emerging issues to improve detection and the operationalization of methods using a case oriented approach. The project builds on existing structures and competencies in foresight and horizon scanning in place at national level and intends to add value by improving existing resources, providing new strategic information and creating synergies exploiting complementarities between initiatives.

Examples of WIWE emerging are included in **Diversification in Medicine** where emerging technologies may lead to new approaches and new health-related service markets. Diminishing trust in conventional medicine, the debate on cultural diversity in medicine and the rising use of complementary and alternative medicine may lead to new requirements with regard to regulation. A growing number of people in Europe

(more than 100 million) are turning to complementary and alternative medicine for disorders they feel cannot be treated with conventional therapy. This field encompasses a number of therapies including herbalism, meditation, acupuncture, yoga, hypnosis, biofeedback, and Traditional Chinese Medicine. Growing demand for alternative therapies may have an impact on the public healthcare system in various ways. People may not seek conventional treatments until their condition is severe, if at all, resulting in poor outcomes for individuals and additional cost to the taxpayer (compulsory health care insurances). On the other hand, the growing demand could support a healthy lifestyle that could lead to lower public health costs. Cosmetic and transgender surgery, laser eyesight treatment, abortion and IVF have become common in healthcare provision and have broadened the concept of health and healthcare and raised issues of who pays. This growth of health-related markets creates an increasing ambiguity and raises many questions on health ethics and health care finance. Development of new technologies (like inexpensive DNA testing, home diagnostics, etc.) will challenge these concepts even further. The quality of life of the elderly is often compromised due to frailty, reduced mobility, dependence on medication, financial limitations and loneliness.

Mental Health in an Ageing Society appears an imperative as the psychosocial consequences of an aging population and the related problems for all member of such a society are not widely known. There are a number of innovative social approaches towards addressing the problem such as communities of care, where elderly people live together in communities where they can be cared for as well as providing companionship to one another.

Improving the mental health and wellbeing of the elderly is an important fulcrum in achieving a sustainable aging. Recent discoveries in invasive and non-invasive reading of brain activity (evoking many ethical and legal issues) highlight the issue of **Cognitive enhancement**: This may involve the use of neural implants as a possible means of unconsciously influencing thinking and emotions (also evoking many ethical and legal questions); Further deployment of cognitive performance-enhancing drugs (leading to unfair advantage academic ability and assessment, but also involving health risks) genetic screening of an increasing number of “Cognitive” genes and In Vitro Fertilization (Eugenics and new problem involving use of animals, experiments with cognitive human-zoo hybrid): Possible development of drugs influencing neuro-cognitive development (how impaired should people be to qualify for treatment?); Commercial interest (neuro-marketing - use of neuro-imaging to research subliminal influence); Cognitive Enhancement of individuals with lower cognitive performance levels (with problems on the insurance border and further widening of social, economic divide) and ICT enhanced learning seems for learning complex cognitive and cognitive motor tasks (augmented reality, virtual reality and gaming).

HEALTH MODELS AND ANALYTICAL FRAMEWORKS

Models are a common outcome in the mapped health related FLA. They do not usually address broad developments in a variety of areas but only specific aspects of the issues under examination in the health area.

DIID produced quantitative models for human tuberculosis infection, disease and mortality in sub-Saharan Africa; population at risk of malaria in sub-Saharan Africa; incidence of paediatric HIV/AIDS in sub-Saharan Africa; risk of malaria and human disease vectors in the UK.

The FLA, OBESITY concluded with two models; a quantitative model for modelling future trends in obesity and the impact on health and a qualitative model for designing and evaluating options for policy responses, based on the knowledge of the key variables influencing obesity development and the range of different ways in which UK society might change in the future. The tool has been tested, refined and validated as part of the UK Foresight Tackling Obesities: Future Choices project and is viewed as having the potential to inform future policymaking.

The Mental Capital project developed a number of conceptual and analytical frameworks including:

Conceptual frameworks

- *Mental Capital through life* – the trajectory of mental capital through life through detailing some of the many factors that influence mental capital and how they are connected across the life course.
- *Learning through Life* – a visualisation of the issues associated with learning through life.

Analytical frameworks

- *Executive function* – influence diagram showing the causal factors involved in the development of executive function.
- *Stigma associated with mental ill-health* – an influence diagram of the many factors affecting stigmatisation and discrimination of individuals.

The FLA on Health Expenditure Projections contains a model allowing projections of health care spending within a common, coherent framework of macroeconomic variables. The model incorporates the recent developments in demography and epidemiology and draws on new insights from health economics, allowing the comparison of the challenges facing both individual countries' health care systems and European society in its entirety.

HEALTH KEY AND EMERGING TECHNOLOGIES

Critical key technologies as they emerged from the FLA encompassed those associated with the use of ubiquitous and mobile technologies; technologies and tools to support teachers in designing and exchanging learning and biomarker substances used as an indicator of a biological state.

Certain future emerging technologies were also highlighted as being of high significance for healthcare in terms of prevention, diagnosis, treatment and cost effectiveness. The FLA on Horizon Scanning of Medical Technologies (Australia) gave considerable detail on emerging technologies.

These include the **Pumpless extracorporeal lung assist device (Novalung)**: enabling the adoption of a less aggressive lung ventilation strategy, less technically demanding, cheaper and associated with a lower incidence of complications; although further evidence in the form of randomised controlled trials (RCTs) is required. **Remote controlled catheter navigational systems** consist of an operating console that can be located outside the operating room, reducing radiation exposure to the majority of the attending medical staff. **Transoral gastroplasty (TOGA® System) for obesity**: Extreme forms of obesity are not likely to respond to dietary, behavioural or pharmacological treatment. Bariatric surgery therefore has emerged as the most effective treatment for these patients: transoral gastroplasty is a new minimally invasive procedure. **Extracorporeal shock wave therapy for the treatment of angina**: Prognosis and quality of life for patients who have severe ischaemia/coronary artery disease and who are not indicated for surgery are poor. Often surgical options will have been exhausted, and alternative forms of effective treatment are lacking. Extracorporeal shock wave therapy (SWT) is emerging as a prospect for this application with the aim of relieving chronic pain and improving quality of life for patients with severe ischaemic heart disease. **eFlow® Rapid nebuliser** for the treatment of patients with cystic fibrosis. CF patients require lifelong intensive treatment including physiotherapy, antibiotic treatment, dietary control and digestive enzyme capsules. Patients with CF have a shortened life expectancy, with the predominant cause of death being loss of lung function, which begins in infancy and continues throughout the patient's life. The Pari eFlow Rapid is a small (fits in the palm of your hand), light weight, portable nebuliser, which is capable of efficiently producing aerosols from liquid medications, such as antibiotics, via a vibrating, perforated membrane. The device is electronic and therefore quieter than conventional compressor type nebulisers. It has been suggested that new nebuliser devices such as the eFlow® Rapid increase the deposition of antibiotic therapy into the lungs with improved patient outcomes which ultimately result in increased patient compliance. The eFlow® device shows potential for improved therapeutic outcomes due to the associated shorter nebulisation times. **Penumbra system for endovascular thrombus removal** for treatment of ischaemic stroke

patients. Ischaemic strokes are more common (85%) than haemorrhagic strokes, and both may affect functions including movement of body parts, vision, swallowing, communication, and may result in death. Nearly all patients are disabled immediately following a stroke event. Common disabilities include permanent paralysis of one side of the body, speech or swallowing difficulties, problems with memory, personality changes or a range of other difficulties. Depression, anxiety and cognitive impairment are also common after stroke. By the end of the first year, about half of all survivors of stroke remain dependent on others for activities of daily living. The Penumbra system has been developed for the early management of ischaemic stroke with the aim of preventing death and the burden of long-term morbidity. The system is designed to restore adequate blood flow via debulking and aspiration of occluding thrombus with the aim of salvaging the ischaemic penumbra, the area surrounding a cerebral infarct that suffers less ischaemia. **SpyGlass® Direct Visualisation System** Gallstones are a major cause of morbidity in Western countries. Until recently, direct visualisation of the pancreatobiliary system for the diagnosis and treatment of lesions in the biliary and pancreatic ducts has been limited by the technical challenges associated with developing a scope capable of allowing direct visualisation of these ducts. SpyGlassR offers direct visualisation for diagnostic and therapeutic applications during endoscopic procedures in the pancreatobiliary system, including the hepatic ducts, in patients with biliary and pancreatic diseases.

It should be noted that horizon scanning in medical technologies is long established and is part of on-going processes used to inform jurisdiction, safety, financing decisions and to assist in the managed introduction of new technologies. It should not be confused with generic commentaries as to the usefulness of new and emerging technologies that are contained in passing in many health related FLA.

HEALTH PATHWAYS AND ROADMAPS

Although some future technologies are identified in some cases, technology roadmaps as such are not a common output in the health FLA mapped. DIID, however, defined roadmaps in four areas:

- Novel information technology for the early detection of infectious disease events;
- Early detection and characterisation of new or newly resistant/virulent pathogens using genomics and post genomics requiring laboratory-based facilities;
- Taking technology for identification and characterisation of infectious diseases to individuals; and
- High-throughput screening for infectious diseases of people, animals and plants using surrogate, non-invasive markers.

Roadmapping in healthcare is fraught with the difficulties that arise from problems of extracting and identifying useful information from huge complex systems that include people, technology and machines. Various sources, including remote monitoring, weather and mobile phone tracking data can be assembled into very large databases containing some relevant and much irrelevant information: all this needs to be filtered and combined with epidemiological models to give timely, accurate response options. The heterogeneous nature of the various database structures and many different representations of data are not easily resolved: data varies in its reliability and its provenance may be uncertain. There is also the issue of public acceptability and privacy issues that may arise. In parallel with, and closely connected with technology developments, is the social problem of obtaining agreement for the widespread international management of information for the public good. This involves a multiplicity of cultural and other concerns. Compellingly, the time taken to address the social issues may exceed that needed for the technology to develop - and the need to address them may therefore be urgent.

Recommending health futures

The 3rd EFP Mapping Report offers a detailed discussion about several outcomes from the 'recommending' phase of Health FLA. This section highlights some key results.

Recommendations from FLA may fall into the following categories: Policies and actions; Initiatives and actors; Appropriation and dissemination; Investments and training; Alliances and synergies and Foresight and Horizon Scanning (FHS) research.

The results from the health-related FLA indicate that policy oriented recommendations are the most common type of recommendations and most often refer to specific initiatives and approaches to dissemination or training. Specificity is natural due to the depth in studying one particular issue instead of spreading across various areas, although it might be considered that many of the recommendations are somewhat vague and generic and lack focus in terms of operationalizing policy frameworks. References to these kinds of recommendations can be found in many of the mapped FLA. They include

- Improving hospital work environments as a relatively low cost strategy on improved healthcare.
- Provision of high level training for medical and healthcare staff by ensuring that, for example, nurses trained to a high level are given the opportunities to exploit their skills in areas such as e.g. nurse prescribing, community nurse-led initiatives such as those in cardiac and diabetes care and potentially increasing the retirement age for nurses (a policy already being considered in many EU countries and across professions).

- Considering recommending a degree of rationing and consolidation of healthcare facilities, as public resources fall short of demand
- Recommending that European governments should improve collection and transparency of health data in order to prioritise investment decision
- Recommending governments tackle bureaucracy and liberalise rules that restrict the roles of healthcare professionals

The RN4CAST study indicates that hospital quality, safety and staff retention problems are associated with organizational behaviours related to nursing: that elements of hospital organization of nursing care are associated to nurse wellbeing, nurse-perceived quality of care, and patient satisfaction and that as a recommendation hospital organization of nursing care is a promising area for international as well as national focus to improve quality of hospital care and the retention of a qualified and committed nurse workforce.

A stronger approach is taken by Mental Capital (UK)) in recommending policy shifts underpinned by:

- Increased treatment and diagnosis instruments for mental health conditions
- Increased provision for depression treatments and other best-practice mental health treatments
- Effective early interventions to address learning difficulties in children including well-designed pre-school parenting programmes for children from disadvantaged backgrounds
- Well designed workplace placement, support and intervention programmes to help those with mental health problems.
- Better use of scientific and other evidence to plan and link interventions that affect mental capital and wellbeing through the life course
- Better decision making, drawing upon better economic analysis of interventions, to take account of wider and longer-term benefits
- Improving the promotion of cross-Government action and central coordination.
- Improving the promotion of cross-Government action and central coordination.

Operationalizing these shifts is viewed holistically in this FLA: measures are needed for increasing investment in capacity and deepening the research base Capacity is linked to the need for fostering dispositions to learning as the global competition for skills intensifies so does the need for individuals to develop their mental capital by training and retraining through their working years in order to compete effectively. Preparing people to meet that challenge will need to start early in life and continue on through the life course. Research is needed to generate better evidence for policy-makers. In particular and among many others, an important objective should be to distinguish between correlative and causative relationships amongst different factors thought to

influence mental capital wellbeing. A longitudinal cohort approach is one way of achieving good quality data to enable the effects of risk factors and interventions to be tracked over the life course. Such data is currently lacking and there could be substantial added value in undertaking long-term cohort studies on an EU basis: comparisons between countries could help in separating out the effect of important socio-economic factors. The development of biomarkers (particularly in the area of depression and dementia associated with ageing) to improve diagnosis of disorders and to promote the development, trial and use of new treatments are viewed as particularly crucial.

Unsurprisingly, as it was conducted by the same agency (Foresight UK) the Obesity FLA, also takes a robust and holistic approach towards the need for significant policy shifts, underpinned by research in tackling obesity. Obesity is viewed as a societal and economic issue and with long-term generational characteristics, the determinants of which are diverse and far reaching in effects and further the phenomenon is not now restricted to high income countries. Economic growth and the impact of new models of food production and consumption require new understandings in food literacy and food skills.

Transforming health futures

'Transforming futures' through impacts is a long-term process which requires significant time after the end of the FLA to be identifiable and their identification necessitate impact assessment exercises which are beyond the scope of the EFP project. Thus, only indications of transforming impacts can be identified based on the recommendations of the mapped FLA.

The health related FLA may lead to all the different types of transforming impacts. Following the Scenarios to 2030 on the future of pensions and healthcare, the WEF produced a separate report on Transforming Pensions and Healthcare which focused on strategic options. These spanned a wide range of areas such as strategies, behaviours, lifestyles and attitudes, current pension and health systems, as well as capacities and skills:

- *Strategic Option 1: Promote work for older cohorts*
- *Strategic Option 2: Shift delivery of healthcare to a patient-centred system*
- *Strategic Option 3: Promote wellness and enable healthy behaviours*
- *Strategic Option 4: Provide financial education and planning advice*
- *Strategic Option 5: Encourage higher levels of retirement savings*
- *Strategic Option 6: Facilitate the conversion of property into retirement income*
- *Strategic Option 7: Stimulate micro-insurance and micro-pensions for the poor*
- *Strategic Option 8: Enhance pension fund performance*
- *Strategic Option 9: Realign incentives of healthcare suppliers*
- *Strategic Option 10: Ensure that cross-border healthcare delivery benefits all stakeholders*
- *Strategic Option 11: Promote annuities markets and instruments to hedge longevity risk*

The FLA of the Foresight UK unit also adopts an integrated approach in defining key choices for policy that may contribute to transforming impacts of various types (capacities and skills, strategies and priorities, systems, behaviour and knowledge-based services).

DIID defined key choices for addressing the conditions for future disease management and detection, identification and monitoring systems, regulation, standards and interoperability. At the same time the study explored implications for science, technology and systems, skills and public engagement.

The Tackling Obesity study, of the same unit, defined principles for developing a national strategy to tackle obesity as well as criteria for an effective obesity strategy. Again an integrated, systemic approach is evident:

- Tackling obesity needs a system-wide approach, redefining the nation's health as a societal and economic issue
- Higher priority for the prevention of health problems, with clearer leadership, accountability, strategy and management structures
- Engagement of stakeholders within and outside Government
- Long-term, sustained interventions
- On-going evaluation and a focus on continuous improvement

After pointing out the key issues in developing a strategy to ensure mental capital well-being in the UK, the Mental Capital project goes even further, as we noted above, to define concrete steps for government. At the same time it highlights that a more strategic and visionary approach is needed involving better use of scientific and other evidence to plan and link interventions that affect mental capital and wellbeing, better decision making, drawing upon better economic analysis of interventions, to take account of wider and longer-term benefits, and improving the promotion of cross-governmental action and central coordination. This indicates transformations not only in strategies but also in capacities and skills, knowledge-based services and the whole policy-making system.

Ageing Society 2030 has a more focused orientation as it produced a specific list of strategically informed research themes and topics in contributing to the realisation of a vision of the development of an age-integrated society. This appears to satisfy the view that it directly contributes to transforming priorities and strategies as well as paradigms and current visions.

The Human Health Climate Change FLA also identified a number of research priorities: Development of methods to quantify the current impacts of climate and weather on a range of health outcomes, particularly in low- and middle-income countries; Development of health-impacts models for projecting climate-change-related impacts under different climate and socio-economic scenarios; Investigations on the costs of the projected health impacts of climate change; effectiveness of adaptation; and the limiting forces, major drivers and costs of adaptation.

The Health in the Green Economy: Transport study identified a number of perceived win-win strategies for transport and health. It is suggested that IPCC considers more systematically health co-benefits (and potential risks) of transport mitigation strategies to highlight policies with the greatest overall gains for society. Furthermore the strategy promotes improved active transport and rapid transit/public transport; more compact land use that integrates urban residential and commercial areas enhancing the climate and health co-benefits of transport strategies; well-tested tools for considering health in transport and land-use policies, including health impact assessment; and investments in

active transport and rapid transit/public transport which can assist budget-conscious ministries to achieve development objectives cost effectively.

More specifically focused health related FLA (RN4CAST and EPIWORK) offer contributions to transforming capacities and skills and knowledge-based products and services through the models and frameworks they developed. EPIWORK developed the GIEaM model, a stochastic meta population approach that integrates high-resolution socio-demographic and mobility data to simulate the spread of epidemics at the worldwide scale.¹⁷ Besides the RN4CAST framework for analysing implications of nurse resources, the study proceeds to recommendations in relation to development and maintenance of healthy work environments to both attract and retain high quality staff. These recommendations refer to improving the working environment and labour conditions, providing incentives and further training. Suggestions are also made for the development of competent nurse leaders who promote staff development, empower employees, encourage and support shared decision-making and collegial collaboration and ultimately create attractive work environments. Thus, the study contributes to transforming competences and skills, and knowledge-based services in the health sector.

¹⁷ See <http://www.epiwork.eu/publications/dissemination/> last accessed 16 December 2012.

CONCLUSIONS

The conclusions of this **FLA Mapping** publication bring together the most important messages from the 1st, 2nd and 3rd EFP Mapping Reports followed by final remarks on the future of FLA mapping.

Key messages from the 1st EFP Mapping Report

All European Commission funded mapping initiatives – EUROFORE (2003–04), EFMN (2005–09) and EFP (2009-2012), have offered important lessons about mapping activities. This section focuses on five major issues:

- How to improve the **interfaces and applications** supporting FLA mapping?
- How to improve the **indicators and key elements** used in FLA mapping?
- How to improve the **interactivity** of the FLA mapping?
- How to improve the **intensity** of FLA mapping?
- How to improve the **impact** of FLA mapping?

INTERFACES AND APPLICATIONS

The first lesson from previous mapping work is the need for more user-friendly, interoperable and dynamic interfaces and applications for the data input, output and analysis (IOA) associated to the mapping activities. In other words, mapping processes need better ways of gathering (data input), retrieving (data output) and processing (data analysis) large amounts of information. These infrastructures should be capable of handling the large number of case studies. We have learned that mapping systems should not only focus on data input, but also pay attention to the development of interfaces and applications helping users to retrieve/find relevant information and to perform basic statistical analyses (i.e. showing histograms representing common practices, players and outcomes). Such systems should also be interoperable with other data management software and be able to analyse the mapping data in real-time.

In spite of these needs, the nature of the EFP project did not allow us to “develop” a new system from scratch. Instead, we took the opportunity to, on the one hand, build a partnership with the iKnow system (see iKnow, 2011a,b), and, on the other hand, adapt existing foresight platforms developed by Futures Diamond, to deliver the Mapping Environment. Thus, the interfaces and applications of the Mapping Environment have fulfilled the needs of the EFP Mapping Work Package (WP2), but the authors of this publication believe that further work is still necessary in order to move from the Mapping Environment **towards a fully-fledged FLA Mapping System**.

INDICATORS AND KEY ELEMENTS

The second lesson concerns the need to improve the mapping indicators and key elements. Previous mapping efforts have mainly focused on understating of FLA **practices** with a few indicators looking at **players**. EFP Mapping has further advanced these dimensions and, at the same time, promoted the mapping of FLA **outcomes**. Table 3 shows how FLA mapping evolved from ‘basic’ to ‘advanced’ to ‘fully-fledged’.

Table 3: Evolution of the FLA Mapping Indicators and Key Elements

FLA Mapping	SMART Futures Mapping	Mapping Indicators and Key Elements	Basic (EFMN)	Advanced (EFP)	Fully-Fledged
FLA Practices	Scoping Futures	Aims and objectives	✓	✓	✓
		Rationales and background		✓	✓
		Context and domain coverage	✓	✓	✓
		Methodology and work plan	✓*	✓	✓
		Territorial scope	✓	✓	✓
		Time horizon(s)	✓	✓	✓
		Funding and duration	✓	✓	✓
FLA Players	Mobilising Futures	Sponsors and champions	✓*	✓	✓
		Research and support teams	✓*	✓	✓
		Methodology and domain experts		✓	✓
		Cooperation and networking		✓	✓
		Participation scale	✓	✓	✓
		Target groups	✓	✓	✓
		Public relations (PR) and marketing		✓	✓
FLA Outcomes	Anticipating Futures	Visions, scenarios and forecasts		✓	✓
		Critical and key technologies		✓	✓
		TEEPSE drivers, trends and megatrends		✓	✓
		SWOT and Grand Challenges		✓	✓
		Wild Cards and Weak Signals (WIWE)		✓	✓
		Pathways and roadmaps		✓	✓
		Models and frameworks		✓	✓
	Recommending Futures	Policies and actions			✓
		Initiatives and actors			✓
		Appropriation and dissemination			✓
		Investments and training			✓
		Alliances and synergies			✓
		(FHS) Research			✓
	Transforming Futures	Capacities and skills			✓
		Strategies and priorities			✓
		Paradigms and current visions			✓
		Socio-economic and STI systems			✓
		Behaviour, attitudes and lifestyles			✓
Knowledge-based products and services			✓		

FHS = Foresight and Horizon Scanning.

RTD = Research & Technology Development. STI = Science, Technology and Innovation.


SWOT = Strengths, Weaknesses, Opportunities and Threats.

TEEPSE = Technological, Economic, Environmental, Political, Social, Ethical.

WIWE = Wild Cards and Weak Signals.

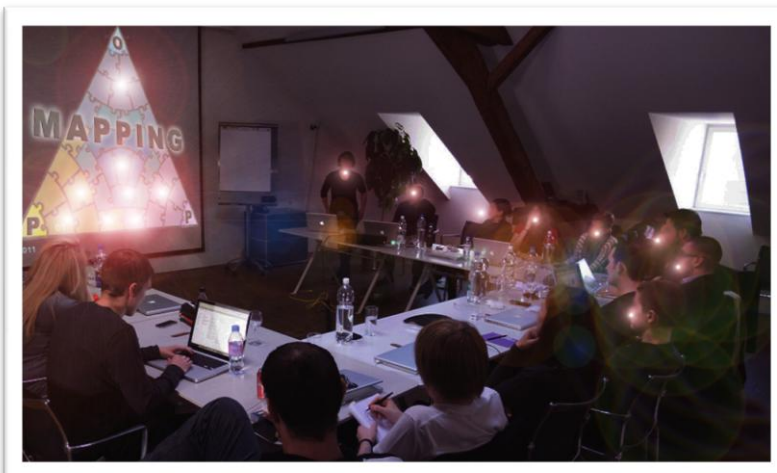
- **‘Basic Mapping’** corresponds to EFMN mapping except for those dimensions marked with ‘*’ (see Table 3 above). For example, EFP mapped all RTD and support teams, while EFMN only mapped the leader of the RTD team. The inclusion of ‘basic mapping’ elements made the EFP work compatible and coherent with previous EUROFORE and EFMN efforts.
- **‘Advanced Mapping’** includes 21 dimensions from practices, players and outcomes.
- **‘Fully-fledged Mapping’** is the most comprehensive mapping type. The 50 cases mapped by the EFP team have aimed at this mapping mode.

Table 4: Potential Role of Key Stakeholders in FLA Mapping

PPO Mapping	SMART Futures Mapping	Mapping Indicators/Elements	Sponsor	Coordinator	Advisors/ assistants	Participants	Beneficiaries	FLA Mappers
FLA Practices	Scoping Futures	Aims and objectives	✓	✓				✓
		Rationales and background	✓	✓	✓			✓
		Context and domain coverage	✓	✓	✓			✓
		Methodology and work plan		✓	✓			✓
		Territorial scope		✓	✓			✓
		Time horizon(s)		✓	✓			✓
		Funding and duration	✓	✓	✓			✓
FLA Players	Mobilising Futures	Sponsors and champions	✓	✓	✓			✓
		Research and support teams		✓	✓			✓
		Methodology and domain experts		✓	✓	✓		✓
		Cooperation and networking		✓	✓		✓	✓
		Participation scale		✓	✓	✓	✓	✓
		Target groups		✓	✓			✓
		Public relations (PR) and marketing	✓	✓				✓
FLA Outcomes	Anticipating Futures	Visions, scenarios and forecasts						
		Critical and key technologies						
		TEEPSE drivers, trends and megatrends						
		SWOT and Grand Challenges						
		Wild Cards and Weak Signals (WIWE)						
		Pathways and roadmaps						
		Models and frameworks						
	Recommending Futures	Policies and actions						
		Initiatives and actors						
		Appropriation and dissemination						
		Investments and training						
		Alliances and synergies						
	(FHS) Research							
	Transforming Futures	Capacities and skills						
		Strategies and priorities						
		Paradigms and current visions						
		Socio-economic and STI systems						
Behaviour, attitudes and lifestyles								
Knowledge-based products and services								

INTERACTIVITY

The third lesson is the need to add interactivity to the mapping process. By interactivity we mean a move from the simple publishing of mapping results to the participatory co-production of mapping-related knowledge. Given that forward-looking activities (FLA) are often conducted and used by several actors, it appears



reasonable to seek the engagement of interested stakeholders in the description and assessment of FLA practices, players and outcomes. However, the active participation of interested parties often depends on, on the one hand, the user-friendliness of the mapping interfaces and applications, and, on the other hand, the particular set of incentives that EFP can offer to promote a “bottom-up” approach to the mapping of FLA.

During the EFP project we designed a number of strategies and incentives to promote a more “bottom-up” mapping of FLA. Now that the Mapping Environment is operational the University of Manchester may pilot some of these ideas beyond EFP:¹⁸

- The establishment of ‘Mapping Ambassadors’ in selected countries in Europe, North/South America, Asia, Africa and Oceania.
- The establishment of a ‘Mapping Credit System’ whereby users are rewarded with Mapping Credits based on their level and type of engagement and contributions. The more a user contributes to the Mapping – by assessing the relevance of mapped practices, players and outcomes for their own country or by contributing to the actual mapping of FLA indicators – the more access to customised information and functionalities the user would have.
- The featuring in the EFP Mapping Environment of the most visited and commented FLA practices, players and outcomes associated.
- The promotion of Mapping Workshops (as illustrated in the image above) potentially organised by sponsors and research teams of selected FLA and supported by the Mapping team at the University of Manchester.
- The preparation of Policy Briefs for FLA mapped at fully-fledged level.

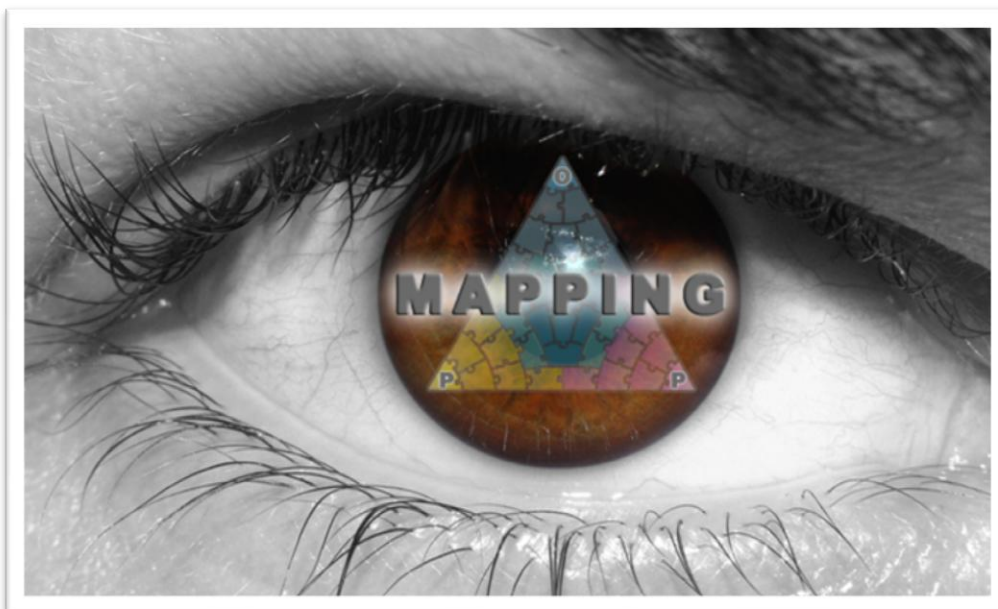
¹⁸ The Mapping work has been at the core of the University of Manchester foresight activities for over a decade since the EUROFORE project led by MloIR (formerly PREST). Despite the end of the EFP project in December 2012, the Mapping team at The University of Manchester will continue improving the Mapping of FLA in terms of: **content** (by contributing to the Mapping Environment with more and better mapped FLA cases), **structure** (by improving the mapping indicators) and **process** (by, on the one hand, improving the functionalities of the Mapping Environment and, on the other hand, promoting more interactivity in the gathering, analysis and validation of the mapping data).

INTENSITY

The fourth lesson relates to the intensity of the actual mapping work. In other words, the time and resources needed for basic, advanced and fully-fledged mapping of FLA. As mentioned in the introduction, the EFMN managed to map over 2,000 FLA. Of those, around 1,000 were mapped against the ten indicators representing the ‘basic’ level of EFP Mapping. This information has been adapted to meet the structure of the EFP Mapping framework in order to be made publicly available in the Mapping Environment. However, the EFP team was also requested to map recent FLA and this required the careful estimation of capacity needs so as to successfully reach the target of 50 FLA:

- 41 cases mapped by MloIR/MBS
- 3 cases mapped by AIT
- 3 cases mapped by IPTS
- 3 cases mapped by TNO

EFP Mapping is a rewarding yet resource-intensive activity which should normally involve several of the following methods: web-scanning (i.e. identifying relevant documents), documentary analysis (e.g. reviewing final/interim reports and related publications), stakeholder interviews/surveys, and occasionally “mapping workshops” (interactive sessions to discuss particular indicators, especially those related to the last two phases of FLA, namely: recommending futures and transforming futures). However, as illustrated in Figure 2 above, the mapping activity can be linked to evaluation practices but should not be considered a substitute or similar in its intensity. Based on EFP experience we estimated that a well-informed researcher requires between 1 and 2 days for each fully-fledged mapping of selected FLA. However, the fully-fledged evaluation of the same FLA would possibly involve a few months of research.



IMPACT

Finally, the fifth main lesson is that the mapping has had already an observable impact in both the policy and the FLA community. How can mapping – through its systematic characterisation of FLA – have an impact? We suggest that mapping can have three different types of impact stemming from the application of, the research about and the inspiration gained from the knowledge resulting from mapping FLA. The three impact types are mainly but not exclusively concerned with the policy, academic and FLA practitioners' communities respectively.

- One way that comes to mind would be the **APPLICATION** of knowledge gained on the basis of mapping by the policy community. Impacts could be direct i.e. when decision makers apply the knowledge with regard to a particular issue or indirect i.e. shaping the culture and acceptance of FLA by the media or think tanks (Johnston and Cagnin, 2011). For example, if an analysis of the mapped health sector forecasts arrive at similar recommendations on how to counter the effects of demographic developments these recommendations would gain a specific weight vis-à-vis other propositions. Moreover, based on the mapping data, decision makers could assess their own FLA policy needs and priorities and e.g. shift their attention and resources to areas – domains or regions – where there have not been many FLA projects. So far the application impact of mapping has been rather small. The UK Parliamentary Office of Science and Technology (POST) used parts of the mapping results in a briefing note on Futures and Foresight.
- In addition, mapping could have an impact on the academic community research by providing its members with data about past FLA for their **RESEARCH** work. We call this type of impact description and analysis. Researchers could analyse past activities, identify patterns, gaps and methodological weakness. Through their analysis they could improve foresight tools and raise the awareness of FLA more generally. Furthermore, two peer-reviewed academic papers published on previous mapping work received the 2009 Emerald Literati Network Awards for Excellence.
- A third type of impact that mapping FLA can have is the concerned with the practice of FLA within the futures community: the mapping could impact by providing FLA practitioners with **INSPIRATION** of how to conduct their projects. While the examination made on the basis of previous mapping has also provided analytical guidance, for example, regarding the use of methods for foresight projects, EFP mapping went beyond this analytical guidance. Practitioners can use the Mapping Environment to explore methodologies and approaches of FLA projects; they will be enabled to consult with peer practitioners and to network with stakeholders who have been involved in similar FLA. The Mapping Environment provides a tool to actually plan, conduct and control ongoing FLA. The EFP mapping, thereby, can be expected to impact on the very way in which FLA are carried out.

Key messages from the 2nd EFP Mapping Report

The security FLA mapped represent a set of forward-looking activities with a European, if not international, scope. The issue of cooperation to transform strategies and visions in dealing with the certain (grand) challenges facing societies is at the core of their justification. Overall, there is a focus on an ambition towards common activities and shared ways of doing things, which may reflect the fact that European security policy has not yet reached a degree of maturity. Engaging key stakeholders and decision shapers as well as generating shared visions and scenarios of European security are among the major rationales in an effort to reverse the fact that defence and security have been confined within national borders.

The domain coverage of the security FLA shows the links of the security area with socio-economic issues as well as technological developments as in the area of ICT. At the same time the strong linkages to the transport area reflect the importance of security research in (critical) infrastructures and interconnected networks, indeed an area of major importance for the EU.

Not surprisingly, the major target audiences are public corporations, government departments and agencies but also the EU institutions, followed by other European bodies and international organisations (OECD, UNESCO, UNIDO, etc.) and NGOs. The surprise here is that the corporate sector is less considered as target audience.

Having an international scope, the security FLA mapped are rather different in their outputs than more traditional security FLA originating in the defence sector where key technologies and technology roadmaps prevail. In this case the primary outputs refer to drivers, trends, scenarios, wild cards, and models / frameworks.

There is no clear separation between drivers, trends, and megatrends. It is often the case that what is emphasised as megatrends or trends is also implicitly or explicitly linked to grand challenges (emergence of new powers, scarcities, climate change, inequalities, demographics, migration, health, role of the individual, importance of non-state actors, financial crisis, new types of conflicts, etc.). However, they all have a strong security perspective in their analysis.

Scenarios have a particular role. They are usually reflections of future states of the world in the event of particular security threats or risks materialise. Hence, they are quite specific. However, there are also a couple of cases where more holistic scenarios are developed, and these mainly deal with the future role of the EU. Similar to the case-specific scenarios certain wild cards are also discussed, again with the security implications at the core of their analysis. Further, the security FLA mapped can form a rich source of analytical and conceptual models about the notion of security, security impacts and implications as well as decision support tools.

The recommendations put forward may concern specific areas of security (like marine security). However, there are several that address European security and defence policy and the need for international cooperation while they also promote the role of the EU in a multi-polar future world. Suggestions for further research form a rich source for future research programming covering both methodological and definitional aspects of security, as well as security implications from certain (grand) challenges.

The ‘transforming futures’ impacts are the ultimate impacts FLA could have. They need significant time to materialise. In this regard, the security FLA mapped can only provide indications of possible future transformations if the recommendations they produce are implemented rather than actual impacts. It is characteristic that several FLA may lead to transformations of all possible types. Some FLA mainly address capacities and skills, behaviour, attitudes and lifestyles and knowledge-based products and services, while others are primarily concerned with priorities and strategies and the socio-economic and STI systems in the security area. This reflects the two main concerns in security research, i.e. the first related to skills, attitudes, knowledge and services around threats and risks, and the second being about upgrading security policies and strategies to the European level and supporting them with the necessary structures.

Key messages from the 3rd EFP Mapping Report

‘The most common aims of the mapped health FLA are to transform ‘strategies and priorities’ and ‘paradigms and current visions’, ‘orienting policy and strategy development’, ‘engaging key stakeholders and decision-shapers’, and ‘identifying key/emerging TEEPSE issues’. Health related FLA are predominantly theme-specific FLA highlighting aims and rationales that are case-specific depending on the specificities of the theme addressed.

Health related FLA are targeted towards the policy world and this applies whether they are nationally or internationally focused. The research community and, surprisingly the business world, are less considered as primary target groups despite the increasing importance given to collaboration between the public and private sectors in dealing with challenges in the health area. This is surprising as health care, disease transmission, remedies and the like are to a very large degree increasingly boundaryless and require transnational and global approaches yet ‘networking and international cooperation’ is not as delineated in the health-related FLA as might be expected. Also of interest, although it is mentioned in some FLA, is the relative low importance (or perhaps emphasis) that has been attached to harmonising supply and demand needs in healthcare. This is also surprising in view of fiscal shocks and the subsequent relative decline implied for investing in capacity.

The health-related FLA mapped have highlighted the importance of recognizing drivers and impacts of changes and forecasting events in the area of health beyond regional and sovereign areas. This reflects an historical trend of moving away from viewing health systems as sickness systems towards systems for preventing illness and maintaining good health. These latter systems are possible because of game changing health technologies, innovative medicines and new approaches in diagnostics. However as the FLA indicate, discontinuities and gaps in policy visions, financial capacities and commitments may represent significant future hindrances.

Demographic shift (in terms of ageing) is generally located as a most significant driver and one like climate change, perceived as highly resistant to remediation in the short or medium time frames. Demography issues are well exercised in the health arena because of the implications of rising costs for managing multiple chronic conditions (a feature of longevity and life style), rising dependency rates and the use of costly medical technology. Following on, visions, scenarios, forecasts in most FLA are preoccupied with issues of demographic trends, rising healthcare costs in order to finance those shifts, the inadequacies of healthcare structures in high and low income countries in delivering services often through lack of skilled personnel combined with the serendipitous effects of climate change, the widening epidemiology of chronic and infectious diseases and perceived changes in social attitudes to caring in communities. Few health related FLA, include analysis or explicit reference to wild cards or weak signals. In many of the mapped FLA scenario and forecasting approaches are viewed as part of management or policy-making toolkits to improve organisational performance and learning.

Recommending and transforming futures in health FLA present themselves as highly complex endeavours because at both the individual and population level they involve a multitude of cross cutting factors only resolvable across many differing time frames and with a range of ethical, governance and cultural dimensions that have to be considered. These latter dimensions of value systems and social/cultural factors drive human behaviour and are not easy to understand nor are they susceptible to rapid change and to the goal transforming futures.

Final remarks about the future of FLA Mapping

The EFP Mapping Results (WP2 deliverables) represent a major step forward in the successful implementation of the SMART Futures approach: A fully-fledged mapping framework capable of informing forward looking research and innovation policy. The **Mapping Environment** and **FLA Mapping** work (1st, 2nd and 3rd EFP Mapping Reports) demonstrate the commitment and leadership of The University of Manchester in the mapping of FLA practices, players and outcomes. Thus, the reader will find obvious that our FLA mapping work will almost certainly continue beyond EFP.

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We wish to thank those experts and colleagues who have supported us in the EFP Mapping activities. In particular our thanks are due to our EFP partners at AIT, IPTS and TNO for their comments and thought-provoking attitude during the project. We would also like to express our sincere gratitude to Ivan Montenegro Trujillo (Colciencias and 2012 Academic Visitor at MBS/MIoIR), Annelieke van der Giessen, Bas van Schoonhoven, Dirk Johann, Elisabetta Marinelli, Joachim Klerx, Matthias Weber and Susanne Giesecke for their inputs to our Mapping work.

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Finally, we wish to express our gratitude to Guillermo Velasco and Monika Popper for contributing to the European Commission efforts to map forward-looking activities (FLA) in Europe and the world.

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Links to the 16 **SECURITY** FLA in the Mapping Environment

1. <http://www.mappingforesight.eu/initiative/eu-grasp/>
2. <http://www.mappingforesight.eu/initiative/sandera/>
3. <http://www.mappingforesight.eu/initiative/foresec/>
4. <http://www.mappingforesight.eu/initiative/festos/>
5. <http://www.mappingforesight.eu/initiative/security-jam-2012/>
6. <http://www.mappingforesight.eu/initiative/dcdc-global-strategic-trends-2040/>
7. <http://www.mappingforesight.eu/initiative/star-trans/>
8. <http://www.mappingforesight.eu/initiative/nic-global-trends-2025/>
9. <http://www.mappingforesight.eu/initiative/espas-global-trends-2030/>
10. <http://www.mappingforesight.eu/initiative/acrimas/>
11. <http://www.mappingforesight.eu/initiative/seron/>
12. <http://www.mappingforesight.eu/initiative/euracom/>
13. <http://www.mappingforesight.eu/initiative/securenv/>
14. <http://www.mappingforesight.eu/initiative/dessi/>
15. <http://www.mappingforesight.eu/initiative/straw/>
16. <http://www.mappingforesight.eu/initiative/pats/>

Further information sources on the 16 **SECURITY** FLA

Note: The selected FLA have been mapped using public sources (e.g. interim and final reports, official documents, newsletters, websites, presentations and policy briefs) freely available in the Internet on 17.12.12. The readers should be aware that some of the links might not be functional in the future.



Website

<http://www.eugrasp.eu>

Key sources

Articles

Policy briefs

Working papers



Website

<https://sandera.portals.mbs.ac.uk>

Key sources

Project results

Scenario report

Security dynamics scoping paper



Website

<http://www.foresec.eu>

Key sources

Final Report

Report on Global Trends and Actors

Report on European Security: Trends, Drivers, Threats



Website

<http://www.festos.org>

Key sources

Final scenarios and indicators report

Final report on potentially threatening technologies

Synthesis of results and policy guidelines report



Website

Web forum at the Security and Defence Agenda

Key sources

Short promotional video

2012 Security Jam report

2012 Security Jam: executive summary



Website

<https://www.gov.uk/mod>

Key sources

Corporate report: DCDC Global Strategic Trends Programme - Global Strategic Trends Out to 2040



Website

<http://www.startrans-project.eu>

Key sources

Project brochure

Project rationales

Project presentation



Website

<http://www.dni.gov>

Key sources

Global Trends 2025 report

National Intelligence Council: Global Trends



Website
<http://www.espas.europa.eu/home/>
 Key sources
[Summary of the report](#)
[Global trends 2030 report](#)
[Video-presentation of the report](#)



Website
<http://www.acrimas.eu>
 Key sources
[Roadmap](#)
[Approaches and solutions report](#)
[Report on current Crisis Management framework](#)



Website
<http://www.seron-project.eu>
 Key sources
[Validation report](#)
[Risk Assessment report](#)
[Identification of Threats to Transport Infrastructures](#)



Website
<http://www.eos-eu.com/?Page=euracom>
 Key sources
[Project brochure](#)
[Report linking risk assessment and contingency planning](#)
[Contingency planning methodologies & business continuity](#)



Website
<http://www.securenv.eu>
 Key sources
[Project brochure](#)
[Project objectives](#)
[Foresight inventory](#)



Website
<http://securitydecisions.org>
 Key sources
[Project flyer](#)
[Report on System of criteria](#)
[Report on Dimensions in security investments](#)



Website

[Project details in FP7 CORDIS portal](#) (Website inactive)

Key sources

[Final report](#)

[Final report summary](#)

PATS

Privacy Awareness through

Security Organisation Branding

Website

[Project details in FP7 CORDIS portal](#) (Website inactive)

Key sources

[Final report](#)

[Final report summary](#)





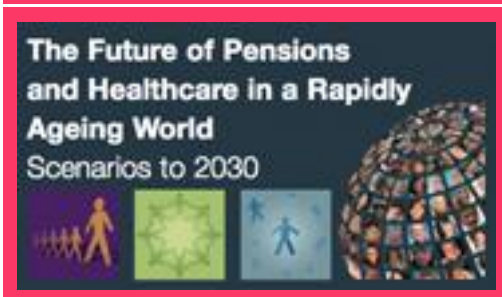
[Periodic progress report](#)

Links to the 20 **HEALTH** FLA in the Mapping Environment

1. <http://www.mappingforesight.eu/initiative/bis-infectious-diseases/>
2. <http://www.mappingforesight.eu/initiative/bis-tackling-obesities/>
3. <http://www.mappingforesight.eu/initiative/bis-mental-capital-and-wellbeing/>
4. <http://www.mappingforesight.eu/initiative/the-ageing-society-2030/>
5. <http://www.mappingforesight.eu/initiative/the-future-of-pensions-healthcare/>
6. <http://www.mappingforesight.eu/initiative/cfwi-public-health/>
7. <http://www.mappingforesight.eu/initiative/aus-nz-medical-technologies/>
8. <http://www.mappingforesight.eu/initiative/epiwork/>
9. <http://www.mappingforesight.eu/initiative/hivera/>
10. <http://www.mappingforesight.eu/initiative/sesti/>
11. <http://www.mappingforesight.eu/initiative/rn4cast/>
12. <http://www.mappingforesight.eu/initiative/eiu-future-healthcare-in-africa/>
13. <http://www.mappingforesight.eu/initiative/eiu-future-healthcare-in-europe/>
14. <http://www.mappingforesight.eu/initiative/2009-ageing-report/>
15. <http://www.mappingforesight.eu/initiative/healthcare-expenditure-projections/>
16. <http://www.mappingforesight.eu/initiative/sicma/>
17. <http://www.mappingforesight.eu/initiative/unicf-child-well-being/>
18. <http://www.mappingforesight.eu/initiative/ipcc-human-health-climate-change-2007/>
19. <http://www.mappingforesight.eu/initiative/who-health-in-the-green-economy-transport/>
20. <http://www.mappingforesight.eu/initiative/aihw-health-and-the-environment/>

Further information sources on the 20 HEALTH FLA

Note: The selected FLA have been mapped using public sources (e.g. interim and final reports, official documents, newsletters, websites, presentations and policy briefs) freely available in the Internet on 17.12.12. The readers should be aware that some of the links might not be functional in the future.

	<p>Website BIS - The Detection & Identification of Infectious Diseases</p> <p>Key sources Action plan Future threats Executive summary of the final report</p>
	<p>Website BIS - Tackling Obesities site</p> <p>Key sources Project Final Report Summary of Key Messages Visualising the Future: Scenarios to 2050</p>
	<p>Website BIS - Mental Capital and Wellbeing site</p> <p>Key sources Executive summary Mental health: Future challenges Learning difficulties: Future challenges</p>
	<p>Website http://en.fi.dk</p> <p>Key sources The Ageing Society 2030 report</p>
	<p>Website http://www.weforum.org</p> <p>Key sources Report on The Future of Pensions and Healthcare in a Rapidly Ageing World - Scenarios to 2030</p>



Website

<http://www.horizonscanning.org.uk>

Key sources

Future Workforce Matters (Issue 2)

CfWI horizon scanning publications

Key shapers of public health skills and workforce



Website

<http://www.horizonscanning.gov.au>

Key sources

Emerging technology bulletin

HealthPACT technology reports

Reports on horizon scanning activities



Website

<http://www.epiwork.eu>

Key sources

Project brief

Project description

Epidemic Marketplace



Website

<http://www.hivera.eu>

Key sources

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Methodology for long-term strategies

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Website

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Patient safety, satisfaction, and quality of hospital care



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EIU-Janssen Healthcare Africa Report

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Key findings

EIU-Janssen Healthcare Europe Report

The future of healthcare in Europe - webpage



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Full report

Report summary

Erratum for table 2.5 in the report



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Key sources

Full report

Economic papers webpage

Summary for non-specialists



Website

<http://www.sicmaproject.eu/>

Key sources

Briefing paper

Project structure

Project presentation



Website

<http://www.unicef.org.uk>

Key sources

Final report - PDF

Final report - webpage

UNICEF's webpage on child well-being



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<http://www.ipcc.ch>
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 Full report
 Cross-Chapter Case Studies
 Report webpage on Impacts, Adaptation and Vulnerability



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<http://www.who.int/>
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 Full report
 Executive summary
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Website
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 Key sources
 Full report
 Report summary
 Report webpage

FLA Mapping References

Note: The references listed here are mainly those related to the FLA mapping work led by the EFP team at The University of Manchester. In order to map each of the FLA discussed in this publication, we have reviewed many more references and key sources which are presented above in two tables including further information sources on the selected *security* and *health* FLA.

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