



FLAGSHIP FINAL REPORT

Grant Agreement: 320330

Project Acronym: FLAGSHIP

Project Full Title: Forward Looking Analysis of Grand Societal cHallenges and Innovative Policies

Funding Scheme: Collaborative project – Small or medium scale focused research project FP7-SSH-2012-2

Date of latest version of Annex I against which the assessment will be made: 2012/09/21

Period covered: from 1 January 2013 to 30 December 2015

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4.1 Final publishable summary report

4.1.1 An executive summary

The world is facing critical changes related to economic, social and environmental issues. However, there are high uncertainties on how these Global Societal Challenges will evolve in the future. Based on past and present information, the Forward-Looking Analysis (FLA) tries to shed light on the nature, level, probability and timing of relevant challenges. The information provided by FLA studies helps us to manage a future situation in a more sensible way. It also allows us to assess the time of occurrence of a particular event and prepare us to focus and face the situation more cautiously. These studies are very helpful to analyse the policy scenarios under different circumstances such as discontinuity and uncertainty of the future, in a world with an increasing interdependency between the different challenges and regions. The FLA is a complex exercise, indeed, anticipate future changes at global and local scale is very difficult when uncertainties are everywhere and the extent of the changes are mostly time unforeseeable. However, FLA exercises are also essential for decision makers in order to reduce the uncertainty and be able to anticipate the future challenges and try to tackle them. The objectives of the FLAGSHIP Project were:

- 1 Understanding and assessing the state of the art of forward looking methodologies in relation to Grand Societal Challenges (GSC) and developing tools and modelling frameworks beyond state of the art;
- 2 Applying an enhanced set of forward looking methods and tools to support EU policies, by analysing reference and alternative scenarios of long-term demographic, legal, economic, social and political evolutions of Europe, in a world context, and assessing potential progress in technological and social innovation;
- 3 Driving change, producing a set of EU-relevant policy recommendations on the potential of the EU for transition and change.

In relation to these objectives, the project aimed at:

- Consolidating a conceptual framework to analyse long term GSC
- Taking stock of the existing forward-looking studies: reviewing the central questions, key trends, critical uncertainties and scenario frameworks;
- Applying and combining enhanced qualitative and quantitative methods mastered by the project partners in a coherent framework, producing a combination of GSC-driven qualitative and quantitative scenarios - coping with a range of possible global paradigm shifts and geo-political changes - and engaging a community of experts and stakeholders in a scenario thinking and assessment exercise;
- Focusing further on EU policy responses to emerging transition challenges, and the potential role of EU in shaping global governance as well as new territorial dynamics within the continent, aiming to deliver policy recommendations to support the formulation of strategic EU policy agendas.

The project was articulated in the following 10 Work Packages (WPs), providing a consistent sequence of research activities with a good balance between methodological developments and policy applications addressing long term GSC scenarios.

WP1: Current appraisal of Grand societal challenges, led by Mcrit, aims at consolidating the FLAGSHIP conceptual framework and reviewing the basis on which the project research and analysis is built.

WP2: Beyond state of the art & enhancement of tools, led by BC3, aims at reviewing the methodological gaps in the FLA exercises that have been conducted to date, setting out the tools to be used in the subsequent application WPs, providing for feasible enhancements of the tools themselves and – thanks to the WP3 Integration Board Task 3.2 – the improvement or refinement of their functional interfaces.

WP3: Integration Board, led by ISIS, aims at facilitating all along the project the integration and the linkages among the qualitative and quantitative analysis of the Grand Societal Challenges conducted in the different work-packages.

WP4: Social and Economic Challenge, led by SEURECO, focuses upon the societal and economic challenges, building macroeconomic scenarios and presenting detailed results of the two pillars of sustainable development: economic and social.

WP5: Environmental Challenge, led by TNO, aims at quantitatively analysing the FLAGSHIP scenarios, concentrating on issues related to the environmental challenges.

WP6: Global Governance Challenge, led by HiiL, aims at developing legal governance scenarios and generating indicators for legal governance trends.

WP7: Territorial Governance, led by S4S, aims at developing a better understanding of the territorial (regional and urban) diversity with regard to global trends (or grand societal challenges) and of how the trends affect the regional and urban development in Europe.

WP8: Policy Conclusions, led by ISIS, aims at drawing the overall project policy conclusions and recommendations.

WP9: Dissemination and stakeholder involvement, led by Sigma Orionis, aims at increasing the project impact through a set of dissemination activities while ensuring a strong engagement of key stakeholders in the project.

WP10: Coordination, led by ISIS, aims at ensuring the administrative, operative and technical management of the project.

FLAGSHIP consortium included 16 partners, listed below, representing 11 European Member States. The FLAGSHIP project has organized 4 stakeholders workshops and 1 final conference, and has implemented a wide and diversified range of participation, communication and dissemination actions.

ISIS	ISTITUTO DI STUDI PER L'INTEGRAZIONE DEI SISTEMI (ISIS)	Italy
OEAW-VID	OESTERREICHISCHE AKADEMIE DER WISSENSCHAFTEN	Austria
BC3	BC3 BASQUE CENTRE FOR CLIMATE CHANGE - KLIMA ALDAKETA IKERGAI	Spain
CEPS	CENTRE FOR EUROPEAN POLICY STUDIES	Belgium
CSD	CENTER FOR THE STUDY OF DEMOCRACY	Bulgaria
HiiL	STICHTING THE HAGUE INSTITUTE FOR THE INTERNATIONALISATION OF LAW	Netherlands
ICS-UL	INSTITUTO DE CIENCIAS SOCIAIS DA UNIVERSIDADE DE LISBOA	Portugal
KNAW-NIDI	KONINKLIJKE NEDERLANDSE AKADEMIE VAN WETENSCHAPPEN - KNAW	Netherlands
MCRIT	MCRIT, S.L	Spain
TNO	NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK- TNO	Netherlands
OME	OBSERVATOIRE MEDITERRANEEN DE L'ENERGIE	France
SIGMA	SIGMA ORIONIS SA	France
SEURECO	SEURECO SOCIETE EUROPEENNE D'ECONOMIE SARL	France
S4S	SPATIAL FORESIGHT GMBH	Luxembourg
SEIT	ESTONIAN INSTITUTE FOR SUSTAINABLE DEVELOPMENT, STOCKHOLM ENVIRONMENT INSTITUTE TALLINN CENTRE	Estonia
SWSPiZ	SPOLECZNA AKADEMIA NAUK Z SIEDZIBAW LODZI UCZELNIA NIEPANSTWOWA	Poland

4.1.2 A summary description of project context and objectives

The FLAGSHIP projects objectives were:

1. **Understanding** and assessing the state of the art of forward looking methodologies - in particular by appraising to what extent and how existing methods are used to assess grand societal challenges and past and current responses to them - and **developing** beyond state of the art tools and modelling frameworks.
2. **Applying** an enhanced set of forward looking methods and tools to support EU policies, notably by analysing reference and alternative scenarios of long-term demographic, legal, economic, social and political evolutions for the European Union in the world context, assessing potential progress in technological and social innovation, and analyse prospective impacts of innovative policies and different global and territorial governance scenarios.

3. **Driving change:** Producing a set of EU-relevant policy recommendations on the potential of the EU for transition and change as a result of the forward looking exercise.

To make the overall approach to these ambitious objectives consistent, FLAGSHIP Project adopted the conceptual model represented in the Figure 1 below:

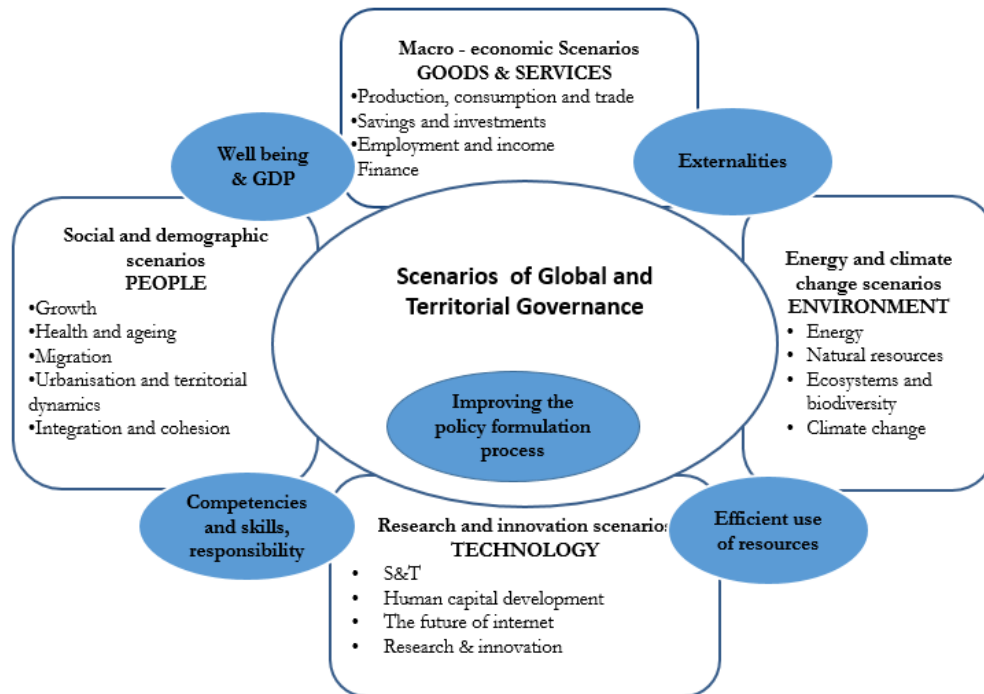


Figure 1: the FLAGSHIP conceptual model

The diagram shows:

- **four thematic areas** – i.e. “people” (demography and society), “goods and services” (economic activities, including the real productive economy and financial markets), “energy and the natural environment”, “knowledge and technology” - **plus global and territorial governance** as key issues at the core, and
- **five critical transition challenges** – i.e. achieving well-being and better quality of life for all; reducing negative environmental externalities of population and economic growth; increasing resource efficiency; adapting people skills and enhancing their empowerment to cope with change; improving governance.

To analyse the above-mentioned four thematic areas and five critical challenges, FLAGSHIP forward looking exercise was developed using a **10 steps scenario approach** illustrated in Figure 2 below, combining quantitative modelling with qualitative foresight:

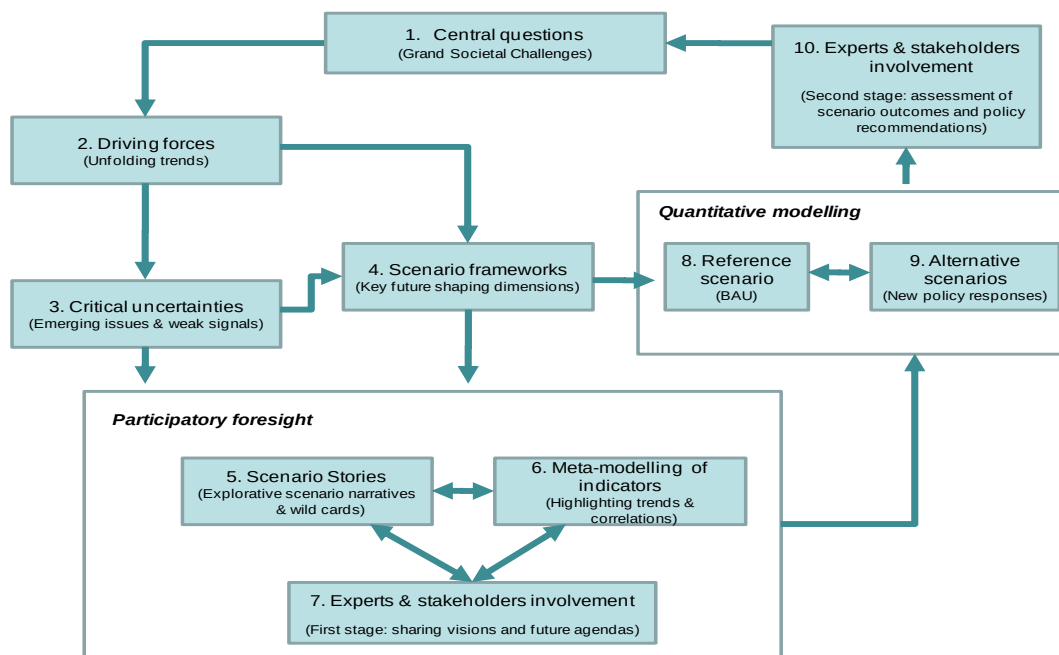


Figure 2 10 Steps to Developing Scenario

To help the consortium partners to orient their own navigation in the forward looking exercise without losing visibility of the overall project scope, the FLAGSHIP partners adopted a relatively simple ‘compass’ to analyse major strategic decisions and a limited number of ‘totem’ indicators to measure progress. The proposed compass has two dimensions: material growth vs socio-ecological transition and global vs multi-level governance. The choice between sustainability and growth must be made at all levels. But a central issue, which remains open, is whether the GSCs arising from global trends, can be addressed without shifting more responsibility to the European, or even the global level. At the center of the diagram, represented in Figure 3 below, stand the global reference scenario to 2030-2050. The forecast are an educated, well-informed, internally consistent guess about what is more likely happen until 2050. The uncertainty band around the forecast is of course wide, but not so wide that it makes the forecast devoid of content, as some demographic and physical variables will continue to follow established trends if no major policy, technology or social innovation changes are introduced (as in any business as usual scenario). Besides the system dynamics forecast, detailed reference scenarios will be elaborated also using different integrated assessment models in relation to the global socio-economic challenges (in WP4) and the energy and environmental challenges (in WP5). A consistency check will be carried out to align the assumptions underlying the reference scenarios across the different modelling applications. Departing from the central reference scenario, the diagram shows two main axes.

- The **horizontal axis represents the sustainability dimension**: on the left the future pathway continues to be oriented towards economic globalization, with the continuation of a liberal global order, more GDP growth and growing inequalities. On the right, the pathway points towards a more balanced social and environmental – in one word “sustainable” – development oriented to prosperity and quality of life beyond the mere income growth.
- The **vertical axis represents the governance dimension**, with the two perspectives considered in FLAGSHIP. The global governance perspective, represented in the diagram by the vertical arrow pointing to the top, whereby new geopolitical developments, government institutions and governance rules in Europe or worldwide change the global game. The territorial governance perspective, represented in the diagram by the vertical arrow pointing to the bottom, whereby the consequences will have to be assessed of possible different allocations of political and fiscal powers in an EU multilevel system of

public finance, or of a new multi-level governance approach to cohesion and other EU sectorial policies with a territorial dimension.

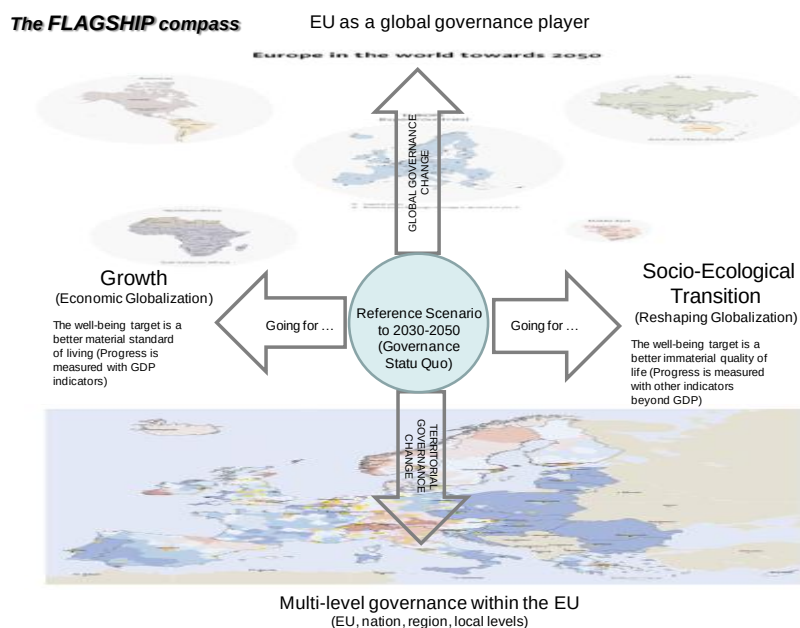


Figure 3 The methods and models

The compass has guided the development and consolidation of the FLAGSHIP Storylines, shortly described in section 4.1.2.2. The Storylines integrated the quantitative forecasts and simulations undertaken per each challenge with a set of modelling tools, as summarized in the table below.

GSC (Leader)	Financial, economic development and innovation challenges (SEURECO)	Demographic and societal challenges (NIDI)	Environmental challenges (BC3)	Global governance challenges (HiiL)	Territorial governance challenges (S4S)
Tools (Leader)					
Indicators, targets and meta-models (Mcrit)	X	X	X		
NEMESIS (SEURECO)	X		X		
Standard cohort-component method for population projections (NIDI)		X			
Extended cohort-component method for human capital projections (VID)		X			
EXIOMOD-RHOMOLO Computed General Equilibrium Package - Hybrid CGE/HAM model (TNO)			X		
Legal Indicators (HiiL)				X	
Targeted spatial foresight tool (S4S)					X

Figure 4 The methods and models

1.2 A description of the main S&T results/foregrounds

4.1.2.1 Setting the scene: appraisal of current Grand Societal Challenges and looking beyond the state of the art

Once consolidated the FLAGSHIP conceptual framework, the FLAGSHIP team conducted an extensive review of literature available on

- megatrends and challenges (including SWOT analyses), as well as the identification of existing policies addressing such challenges and the corresponding quantitative policy targets. The results are five thematic reports related to Economy and Technology; Demography and Society; Environment and Energy; Global Governance; Territorial Governance.
- existing literature on Forward Looking Activities studies related to the key sectors, their strengths and weaknesses and gaps in the literature and an analysis of the linkages, conflicts and inconsistencies with other spheres;
- the tools to be used to assess each of the main Global Societal Challenges

Key references identified were included in a Virtual Library, published in FLAGSHIP web-site (<http://81.47.175.201/flagship/>). Besides scientific and institutional papers and reports, other sources were also reviewed, including publication issued by key thinkers, movies and narrative literature. Modern visions of the World, and its future, either expressed in political visions, in literary fictions or popular movies, are embedded into variations and recombination of the myths shared by all human cultural traditions. Scientific analysis and social predictions are made by applying theories based on our best understanding of past events, but after all, theories are always derived from intuitions and prejudices. A paper was prepared including a review of movies and narrative literature. The outcomes were published in the web-site (http://81.47.175.201/flagship_myths/) including movies representing different myths, and speeches by key thinkers. 7 videos were prepared using excerpts of the movies reviewed to illustrate the different myths.

4.1.2.2 The FLAGSHIP Storylines

ISIS coordinated the work for the elaboration of the scenarios blueprint. The blueprint - released in several versions throughout the project duration – accompanied the research and future scenario building and assessment exercises undertaken to address the grand societal challenges ahead of us in several fields: economy and innovation, demography and education, energy, climate change and the environment, global governance and territorial governance in the European Union.

The FLAGSHIP approach combined quantitative analysis based on a set of models with the elaboration of qualitative storylines of possible futures. A meta-modelling approach was also used to bridge the quantitative and qualitative counterparts of the scenario building exercise.

Two future outcomes are explored in FLAGSHIP, and storylines developed to illustrate how the future will unfold according to two perspectives:

- **Global perseverance with neo-liberal economic growth paradigm** This is the currently mainstream vision assuming: i) the continuation of current global growth-driven trends and policy reforms, and ii) the effects of a perpetuation of the European Union 2020 strategy for smart, inclusive and sustainable growth after the 2020 horizon.
- **Global metamorphosis to a sustainable progress paradigm.** This is a vision assuming a more radical paradigm shift of the global economy towards sustainability. The shift is achieved thanks to breakthrough improvements of resource efficiency and reduced per capita energy and materials consumption, extensive behavioral change and the rise of non-market and social forms of economy. The latter will contribute to reduce inequalities and achieve prosperity, beyond the benefits that the slow GDP growth may deliver. This scenario considers also a new European governance setting and policy strategy after 2020.

The attribute “global” used for both storylines is intended to emphasize that the perspective of the FLAGSHIP global storylines is the whole world,. It is important to underline the “additive” rather than “contrasted” character of the two storylines, at least in terms of the fit to sustainability goals

that both scenarios aim to deliver. They are both positive scenarios, achieving better future outcomes in terms of economic, environmental and social sustainability for the European Union and the world. But the second – global metamorphosis – is meant to add in the picture new features and opportunities that will allow to achieve a better sustainability fit.

The first storyline, called *Perseverance*, is driven by mainstream conventional thinking based on projections of current trends. In this vision, GDP growth remains the main focus of decision-makers and policies tend to be reactive rather than anticipate future changes. The second storyline, *Metamorphosis*, is more daring and normative in nature. It assumes that a fundamental and systemic change is needed to build a future that is more just, environmentally healthy and more legitimate overall. In this vision, the well-being of citizens and a greater democratisation of the system (including politics, information, knowledge, capital ownership etc.) are the main targets of policy-makers, which anticipate future challenges and aim to influence emerging trends.

To frame the whole foresight approach we used the Three Horizons Framework (THF), illustrated in the figure below.

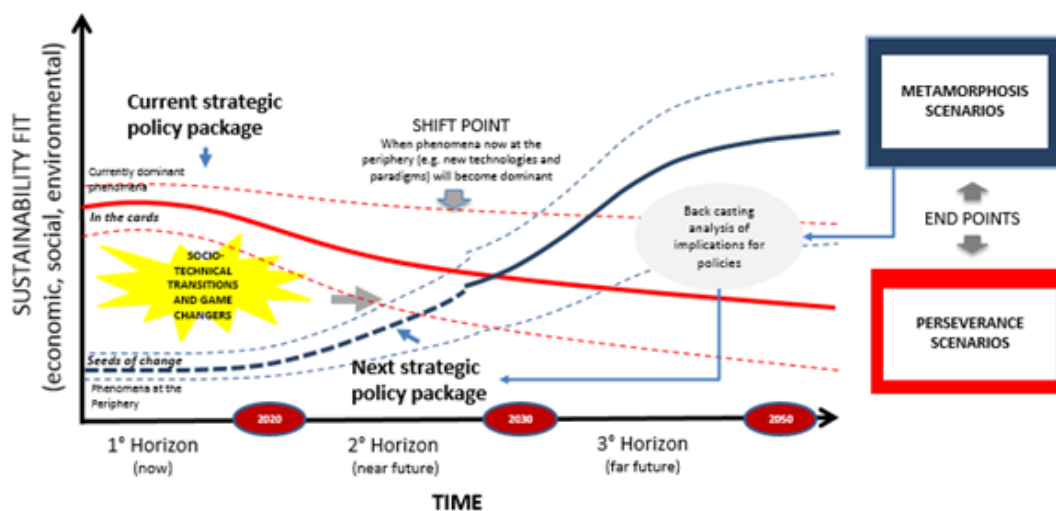


Figure 5: the Meta-model framework

The plot shows three time periods on the horizontal axis – until 2020, 2020-2030 and until 2050 – and a measure of sustainability fit on the vertical axis. The plot is conceptual, not empirical, and the sustainability fit can be interpreted as a kind of composite measurement of the achievement of economic, environmental and social goals.

In this framework, the “first horizon” is what is most visible today – what is in the cards based on current trends, policies, regulations, operating assumptions, prevailing behaviours and dominant paradigms and mind-sets of experts, stakeholders and policy makers. In the first horizon is the “perseverance” outcome that will continue to unfold until 2050 (red line), delivering a range of impacts on sustainability dimensions that are deemed to be – at the best – “good but not enough”.

The “third horizon” is what is less visible today, as it is a possible outcome that can emerge if current phenomena at the periphery – “weak signals” – grow and become wider drivers of change, delivering radical transformations and paradigm shifts in the long term. The “metamorphosis” outcome may eventually deliver the best fit to sustainable goals in the year 2050 (blue line).

Finally, transition strategies and novel implementation pathways – e.g. new policy strategies, game changers etc. - populate the bridging ‘second horizon’. This is the intermediate period of time where options are open to make the third horizon change happen, conflicts may be solved, barriers overcome, new strategies and policies implemented. In a nutshell, it is the space where new future outcomes can be enabled by policy or social changes, where game changers may show their effects and new paradigms emerge as dominant elements of the landscape (shift point). It is also

the period where we imagine that new strategic policy packages will be implemented to drive the European Union towards the metamorphosis pathway, and the figure shows how these new packages can be influenced by the conclusions of our back-casting analysis.

The following figure shows the range of impacts expected for the two scenarios. The range of metamorphosis scenarios sustainability fit achievements is deemed to be altogether higher than the range expected for the perseverance scenarios. However, in the worst case the metamorphosis outcomes may prove to be “disappointing”, i.e. achieving a sustainability fit lower than what is achieved in the best perseverance scenario case. The latter would deliver a positive outcome, but still not enough if compared to what may be achieved in the best metamorphosis scenario. It is important to note that here we are only speculating on ranges of expected impacts for the two scenarios, without any consideration of the expected costs of policies and interventions that the scenarios would entail.

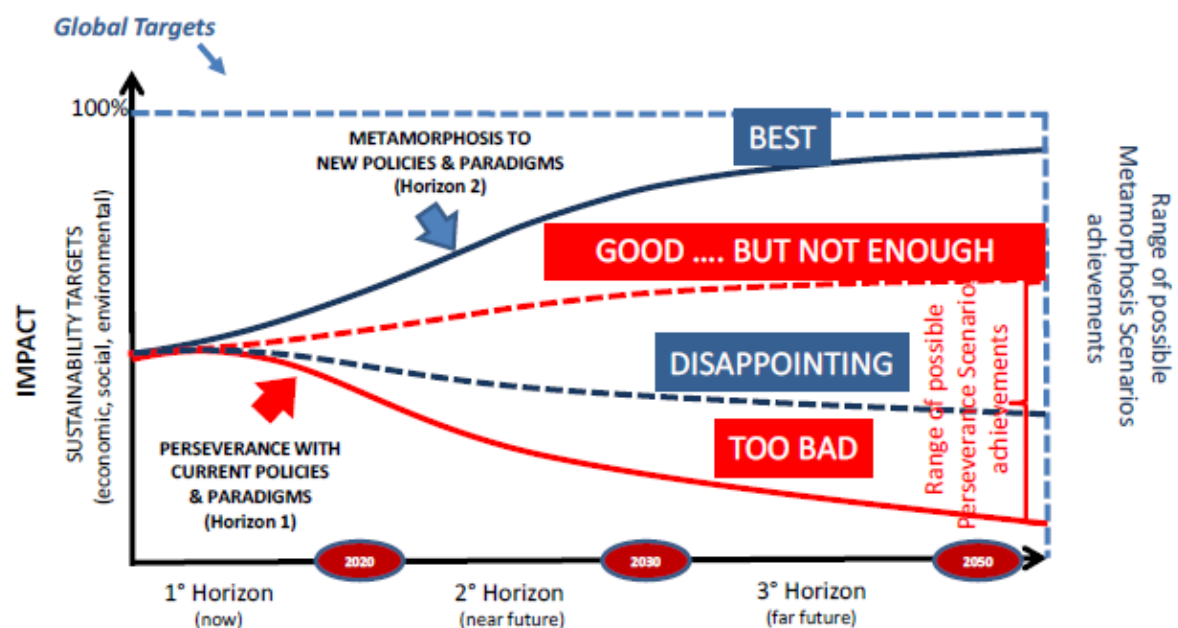


Figure 6: the Meta-model framework

Based on the Three Horizons framework, the whole FLAGSHIP foresight exercise was articulated in 3 steps:

- First, analyse the current picture of dominant trends, challenges and seeds of change at the periphery (first horizon).
- Second, envision alternative future outcomes as a result of global perseverance and – beyond that – of global metamorphosis (third horizon).
- Third, make one step back to describe the key drivers of change, game changers and policies conducive to the alternative future outcomes (second horizon).

While envisioning the outcomes of the metamorphosis scenario in the third horizon, it is important to establish that the concept of “metamorphosis” is conceived as something “beyond” the perseverance perspective. The future BEYOND is not WITHOUT most of the features present in the perseverance scenario, but rather a world where more and new options are available and implemented to achieve a better sustainability. So, as will be more extensively discussed in the metamorphosis storyline presented in section 4 below, the metamorphosis scenario can be understood at a glance as a list of “10 beyonds” (with respect to the perseverance scenario):

- Beyond oil, there will be still oil reserves (as beyond the stone age, there are still stones), but much more renewables and energy saving.
- Beyond waste, we will have still some end-of-pipe waste, but a lot of materials will be recycled or their needs reduced (circular economy).

- Beyond carbon, there will be still carbon emissions – they are a natural fact – but not in excess as they are today.
- Beyond migration, we will have still global migratory flows, but not accelerated as they are today and accompanied by more integration and inter-culturalism.
- Beyond retirement, there will be still pensions and social welfare outlays, but more equitably distributed and accompanied with more active and healthy ageing.
- Beyond capitalism, there will be still capitalistic markets, but these will be no more the only form – nor the dominant one – of exchange and value creation.
- Beyond consumerism, we will have still growing consumption, but mostly of services and intangibles – and with a growing contribution of collaborative forms of consumption/sharing.
- Beyond the Internet of Things, we will have a socially responsible development of the information society.
- Beyond GDP, we will measure other aspects of progress as well, calculating and using for policy making sustainable development indicators encompassing population well-being, ecosystems health and resilience, social cohesion.
- Beyond nations, we will have still nation states, but no more borders. Regional cooperation and solidarity across nations, as well as a greater involvement of cosmopolitan and locally empowered citizens, will become key elements of the future global and territorial governance.

4.1.2.3 The FLAGSHIP meta-modelling approach

Meta-models are envisaged as strategic tools between qualitative scenario narrative-making and complex resource-intensive modelling exercises. Meta-models are meant to be complementary to forecast models to perform tasks like testing assumptions and innovative qualitative concepts, undertaking quick pre-analyses before running more resource-intensive models, or exploring evolutions that are a far distance from mainstream trend lines, which models cannot consider.

The models are open source, programmed in EXCEL, and available for public use and can be adapted to upgrade their functionalities. The full description of the meta-model formula are presented in the Deliverable 3.2 available at www.flagship-project.eu.

In order to analyse the various components that the FLAGSHIP project deals with, four different meta-models are proposed, as follows:

- Welfare Module, adapting the I=P·A·T approach in environmental science developed by Ehrlich, Commoner & Holdren to assess welfare, understood as a combination of affluence (A), equity (C) and environmental standards (E). Inputs for the welfare formulation are generated in the next three meta-models.
- Affluence Module, based on Luca Ricolfi's essay "L'Enigma della Crescita". It analyses economic growth per capita (affluence) based on a simplified Solow approach without technological progress. Economic growth is understood as mostly dependent on human capital, high levels of foreign direct investment, efficient and transparent (economic) institutions and governance, and low business taxation (Ricolfi's economic fundamentals); it is also heavily influenced by the level of a country's income per capita (wealthier societies tend to grow less than societies under development).
- Cohesion Module, based on Thomas Piketty's book *Capital in the 21st century*, dealing with expected growing inequities in the 21st century in societies where the return obtained from property ownership (rents) becomes more important than the growth rate of salaries, which are generally driven by economic growth. In societies where this happens (capital return > economic growth), ownership becomes more productive than work, and the gap between wealthier classes and middle and lower classes tends to increase.
- Environmental Module, based on Jørgen Randers' essay "2052 A Global Forecast for the next 40 Years". The author suggests the use of cross elasticities to economy and technology to

provide a holistic analysis of needed game changers and trend breaks to meet environmental and energy challenges toward the middle of the 21st century.

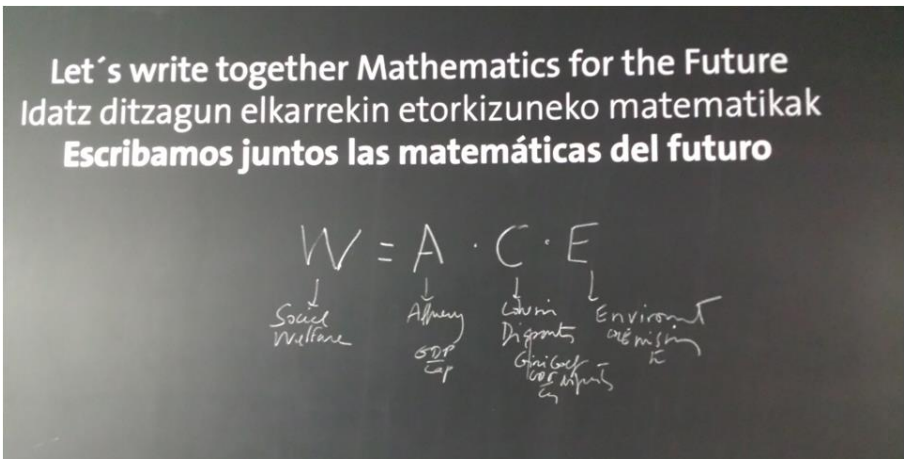


Figure 7: the Meta-model framework

Example of the affluence meta-model. The graphical interface of meta-models is designed to be intuitive and user-friendly. Users can edit and extend their capabilities depending on their particular needs.

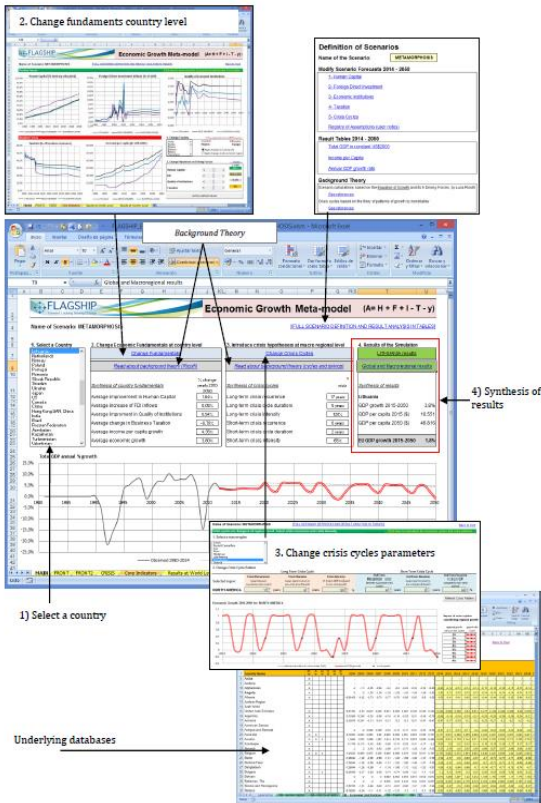


Figure 8: Affluence meta-model interface

Inside the applications in Flagship

Affluence meta-model. The Metamorphosis scenario is based on a more balanced distribution of wealth growth in the world and also in Europe. This would be promoted by a significant improvement in governance, education and the business climate in lagging countries. The result of this strategy would reduce gaps between lagging economies and more advanced economies, especially in Europe, but overall economic growth would remain in the same order of magnitude or even increased (to around 15% more global GDP).

Cohesion meta-model. Under business as usual conditions, the Perseverance scenario, 17 European countries would increase social inequities between 2010 and 2050, up to 9% in countries having a tradition of strong welfare systems like Sweden or France and Austria. Inequities are defined as the ratio (%) of wealth concentrated by top 10% most affluent citizens, and the share in income distribution of middle classes (understood as the percentile 50-90).

The implementation of a global tax on wealth of 1% up to 2030 and 2% thereafter until 2050 could reverse this trend, with only two European countries still increasing inequities between 2015 and 2050, despite the tax (limited to 4%), and all other countries tending to decrease inequality ratios in the period.

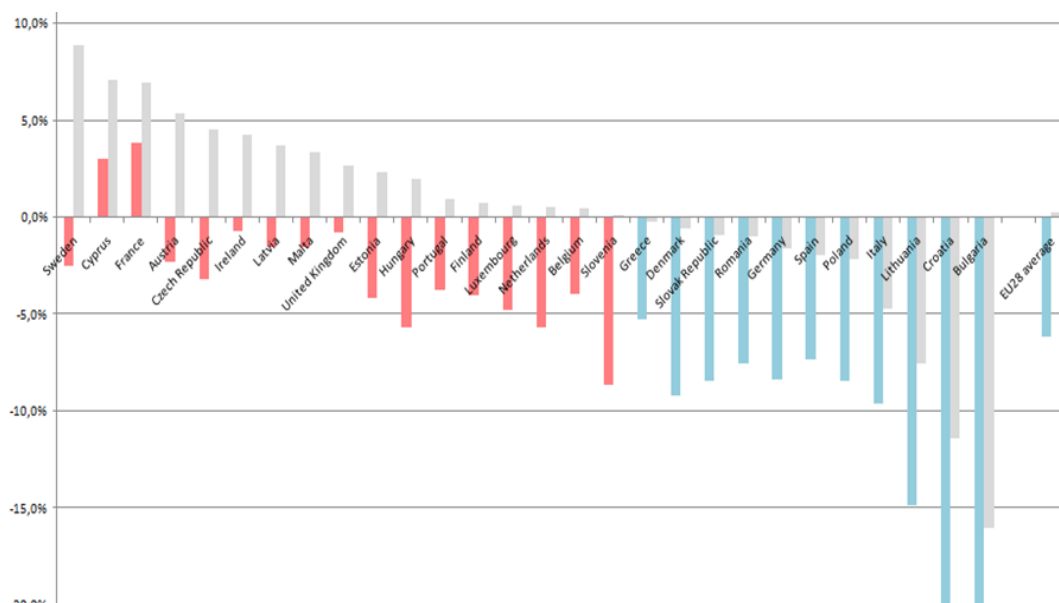


Table 1 Cohesion meta-model. Country inequalities in Europe, for Metamorphosis scenario (in grey, Perseverance scenario as a reference).

Environment meta-model In the Perseverance scenario, despite very challenging emissions targets by the EU and the US (and partially by China), global emissions still increase a full 100% from 1990 to 2050 with a cumulated total CO₂ tonnes emitted during the period of 2,000 billion tons of CO₂. In the Metamorphosis scenario, with a global agreement to distribute emissions reduction commitments to countries where interventions are most cost-efficient, overall global emissions increase only 40% with respect to 1990 levels. However, the EU and the US commit to emissions reductions at much lower levels than in the Perseverance scenario (16% and 26%, respectively), resulting in a total carbon footprint of 1,850 billion tonnes of CO₂. The Metamorphosis best variant is introduced whereupon the global strategy set off by the Metamorphosis scenario induces the EU and the US to maintain their current commitments of reducing GHG emissions. As a result of this additional effort, global emissions in 2050 return to 1990 levels, producing a total carbon footprint of 1,750 billion tonnes of CO₂ emissions.

Welfare The long-term trend of welfare in FLAGSHIP scenarios is to increase across countries of the World along time, between 1990 and 2050. Even when rhythms may vary from country to country, income per capita generally increases for all scenarios and the environmental footprint per unit of GDP tends to decrease for all scenarios, thanks to better technology and changing

behaviour. Only social disparities within countries tend to increase under business as usual conditions.

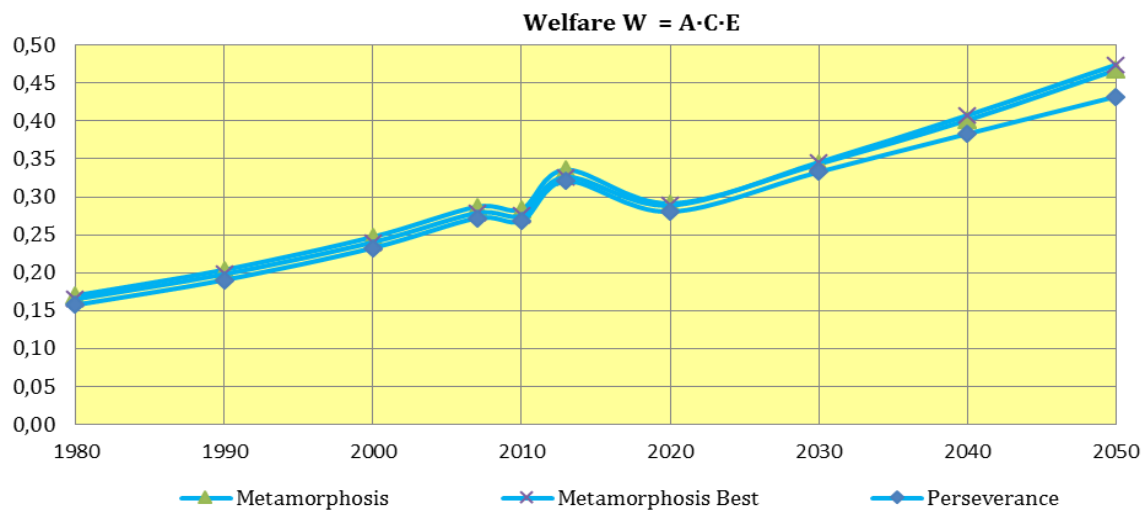


Table 2 Welfare meta-model. Progressing welfare over time at the global level

Given the low environmental performance of European countries in an approach where emissions reduction commitments are distributed according to cost-efficiency criteria (Perseverance basic assumptions), a Metamorphosis best scenario variant is proposed in which a more pro-active European and US policy is given in relation to environmental issues, maintaining current emissions targets. Under this variant, 90% of countries in Metamorphosis increase welfare in relation to the Perseverance model.

The next table ranks countries according to their Welfare performance as in 2013, and in 2050 for the two FLAGSHIP scenarios and for the Metamorphosis Best variant.

2013	Perseverance	Metamorphosis	Metamorphosis Best
Norway	Belgium	Japan	Belgium
Switzerland	Japan	Ireland	Japan
Ireland	Netherlands	Belgium	Ireland
Denmark	Ireland	Republic of Korea	Netherlands
Sweden	Finland	Hong Kong SAR, China	Finland
United Kingdom	United Kingdom	Finland	United Kingdom
Finland	Germany	Netherlands	Republic of Korea
France	Spain	United Kingdom	Hong Kong SAR, China
Austria	G7 group average	Norway	Germany
Japan	Denmark	Switzerland	Switzerland
Netherlands	Republic of Korea	Canada	Norway
Belgium	Switzerland	Germany	Denmark
G7 group average	Hong Kong SAR, China	Denmark	Spain
Germany	Canada	Australia	G7 group average
Italy	Austria	G7 group average	Canada
Australia	Australia	Spain	Australia
United States	France	Lithuania	Lithuania
New Zealand	Norway	New Zealand	Austria
Canada	New Zealand	Austria	Italy
Spain	Italy	OECD	EU average
OECD	EU average	France	New Zealand
EU average	MEDs	Sweden	OECD

Table 3 Welfare meta-model. Top welfare countries in 2013 and according to FLAGSHIP scenarios

4.1.2.4 The Economic challenge

The two scenarios developed, “Perseverance” and “Metamorphosis”, in the European economic context are based on the FLAGSHIP storylines (ISIS et al., 2013 [11]; ISIS et al., 2015 [12]) and have been quantified with the help of the NEMESIS model (Zagamé et al., 2010 [14]). These quantifications allow to represent the main concerns put forward in the storylines: ageing, availability of resources, reduced investment, innovation and productivity rates and the raise of inequalities. The two scenarios describe two different ways to address these challenges, with the “Perseverance” scenario referring to current and more traditional policies, whereas the “Metamorphosis” scenario focuses on the development of the circular economy and the switch towards a resource revolution. Although both scenarios include and simulate the impact of assumptions on reforms of the economic governance, neither one nor the other escapes the need to introduce additional policies to enhance productivity gains, reinforce economic growth, consolidate employment creation, reduce inequalities and overcome environmental issues. The work achieved herewith analyses some of these potential policies in each context and assesses their economic performance for the European economy, in terms of economic growth, inclusiveness or structural changes.

Description of additional policies

The advocated additional policies primarily refer to “knowledge policies”, designed to tackle a variety of economic challenges, related to ageing or low productivity in services sectors, by at first increasing productivity gains. Nevertheless, the spirit as well as the nature of these policies will be different in the two scenarios.

In the “Perseverance” scenario, the knowledge policies are oriented towards technological innovation, competitiveness and economic growth. Accordingly, knowledge policies are primarily driven by R&D investments. It is assumed that each European Union member state reaches the R&D intensity target defined in the National Action Plans for the Europe 2020 strategy. Even if these targets are not fully reached in 2020, the “Perseverance” scenario assumes an incremental R&D intensity of 0.1 pt of GDP per year from 2015 onwards until the achievement of the R&D intensity targets. And as the National Action Plans (NAPs) differ significantly between member states, the investment effort in the innovation inputs is also very heterogeneous, ranging from no effort at all to 1.5 pt of GDP. As a result of this kind of innovation policy in the “Perseverance” scenario, productivity, competitiveness and GDP growth are raised.

In the “Metamorphosis” scenario, the goals are slightly different. Instead of pure economic performance, the scenario is set out to describe a European economy more oriented towards social and environmental sustainability. For instance in the “Metamorphosis” context, the development of the circular economy, as well as the resolution of the resource’ scarcity call for breakthrough policies. The need to increase the productivity in the services sector pleads for large ICT deployment but also for the development of other intangible capital, such as organisational capital or education and training. Thus in the “Metamorphosis” scenario, the “knowledge policies” for enhancing technological innovation are based on R&D investments but also on other innovative assets: ICT and other intangible capital. In the “Metamorphosis” scenario, the knowledge of the economic actors goes beyond pure “science and innovation”; it also includes additional values such as environmental awareness, reinforcement of social and cultural links, social cohesion or ethical values. The possible policies driving these changes in values are numerous, including education and training, awareness campaigns, social marketing and collective actions, but they can be also the result of wildcard occurrences (nuclear accident, extreme flooding or storm or geopolitical instability, etc.).

Knowledge of science in the “Perseverance” scenario: Productivity and economic growth

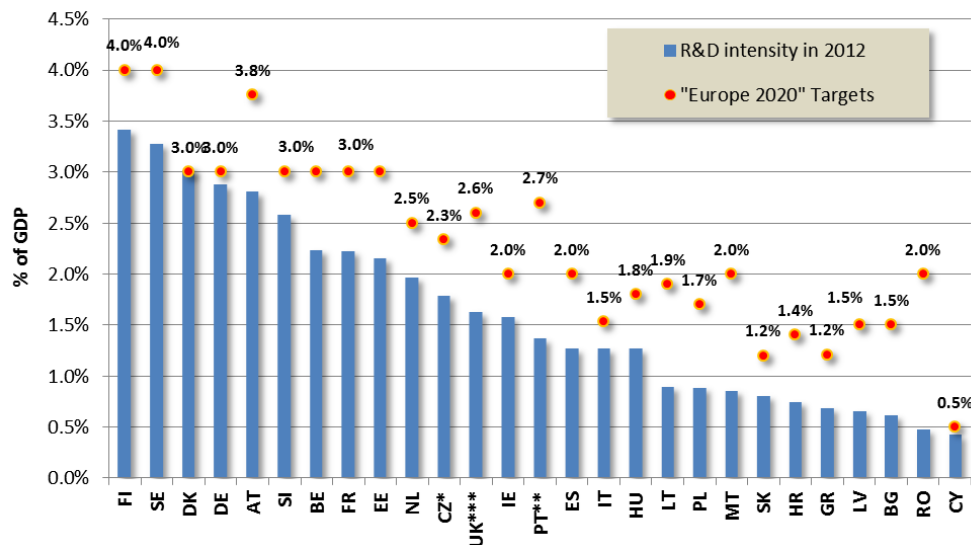


Figure 9 R&D intensity and NAP targets in member states - Sources: EC (2012 [6]) and Eurostat (2015 [7]). * Official targets 1% of public R&D intensity. ** Lower bound of the NAP target. *** No official target.

The innovation policy response in the “Perseverance” scenario is an increase of the R&D efforts to achieve the National Action Plans of the Europe 2020 strategy in each member state. Due to the state of the R&D intensity and their gap with respect to the NAP targets, the investment efforts are very heterogeneous between countries (Figure 9). And to remain realistic, the annual incremental R&D intensity in each member state has been limited to 0.1 pt of GDP, with 33% of the incremental efforts devoted to public R&D investments.

The mechanisms of the model involved in such policies are well known (Brécard et al., 2006 [5]; Fougeyrollas et al., 2014 [8]). The investments in R&D increase the knowledge in every sector by two channels: directly by the own R&D expenditures and indirectly by the R&D efforts in others sectors in the domestic country as well as in others countries (knowledge spillovers). The accumulation of knowledge induces process innovation (productivity growth) and product innovation (quality improvement), which improve competitiveness and then increase external balance and internal demand for every sector. In the end, however, the macroeconomic feedbacks mainly induced by the wage curve, increase private consumption and prices, which reduces the gains achieved by competitiveness.

Knowledge for science in the “Metamorphosis” scenario: The whole set of innovative assets for more inclusive economic performance

More radical breakthrough policies are implemented into the “Metamorphosis” scenario. The innovation policy goes beyond pure R&D targets and uses the new endogenous growth module of the NEMESIS model (Fougeyrollas et al., 2014 [9]; Boitier et al., 2015 [3]) to allocate optimally the same investment efforts between three different innovative inputs: private and public R&D, ICT investments and other intangible assets (software and training, in the model).

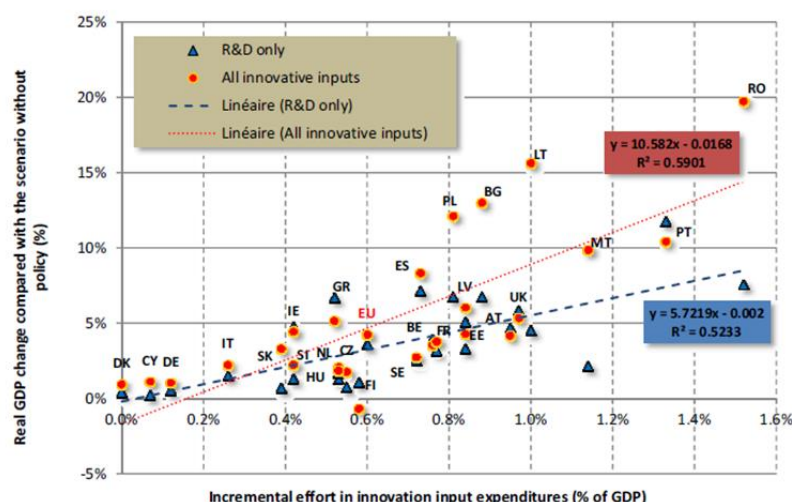


Table 4: Economic performance of innovation policies - Source: NEMESIS Model

Table 4 shows the results of both scenarios (“Metamorphosis”: red dots and “Perseverance”: blue triangle) for each member state in terms of GDP gains and relates them to the incremental efforts in R&D investments in the case of the “Perseverance” scenario and in all innovative inputs in the case of the “Metamorphosis” scenario. If on one hand, aggregated results are relatively similar at European level, with +3.6% of GDP in 2050 in the “Perseverance” scenario and +4.2% in the “Metamorphosis”, on the other hand, the results by country are more varied. Table 4 displays a stronger efficiency of the innovation policy when applied to all innovative inputs, especially for less advanced EU countries. Indeed, ICT and other intangibles produce more inclusive innovations than R&D investments insomuch as they are more favourable to sectors less exposed to international competition but also because the knowledge externalities of ICT and other intangibles are more related to the use of innovation (Fougere et al., 2015 [10]). Thus, in less-advanced European economies, knowledge spillovers emitted as well as received from R&D (more related to the sector of manufacturing of the innovation) are weaker than ICT and other intangible ones. Furthermore, when R&D investments enhance the productivity and the quality of goods in the manufacturing sectors, the extension of the innovation to all inputs spreads the productivity gains across all sectors and particularly enhances the productivity gains in the services sectors, which are usually less progressive (Figure 10). By the way, it avoids, or at least reduces, the pitfall of Baumol’s cost disease (Baumol and Bowen, 1965 [2]; Baumol et al., 2013 [1]) in the services sectors.

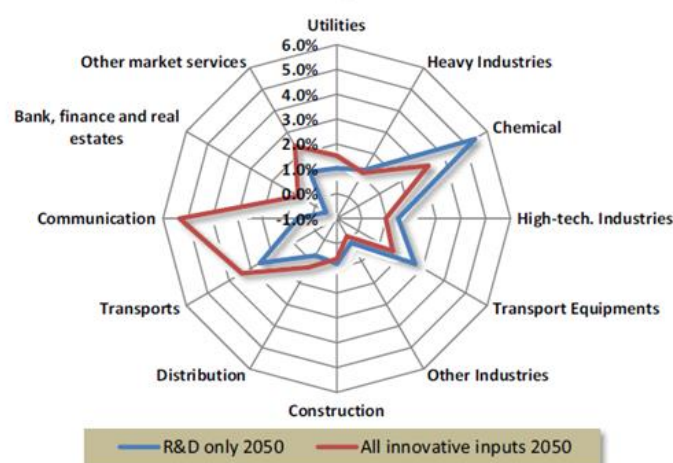


Figure 10 European sectoral labour productivity gains in both innovation policies in 2050 - Source: NEMESIS Model

Knowledge for consciousness and awareness beyond science

In the last policy case - implemented only in the “Metamorphosis” scenario - knowledge is characterised by a change of consumer and citizens’ values through a better awareness of environmental and societal challenges. It is represented with the help of modified utility functions of consumers. The underlying hypothesis of the behavioural change of consumers is based on educational policies, awareness campaigns, labelling or civil society mobilisation as well as potential wildcards. Thereby, the consciousness and awareness of the citizens is materialised by a reallocation of private consumption expenditures (Boitier et al., 2015 [4]). This reallocation of consumers’ expenditures is oriented towards a more ecological and social responsibility of the consumers’ choices.

Thus, consumers direct their purchases towards domestic services, medical care, entertainment, communication, thermal renovation, public transport at the expense of fossil fuels, private cars, household equipment or clothing (see Figure 11).

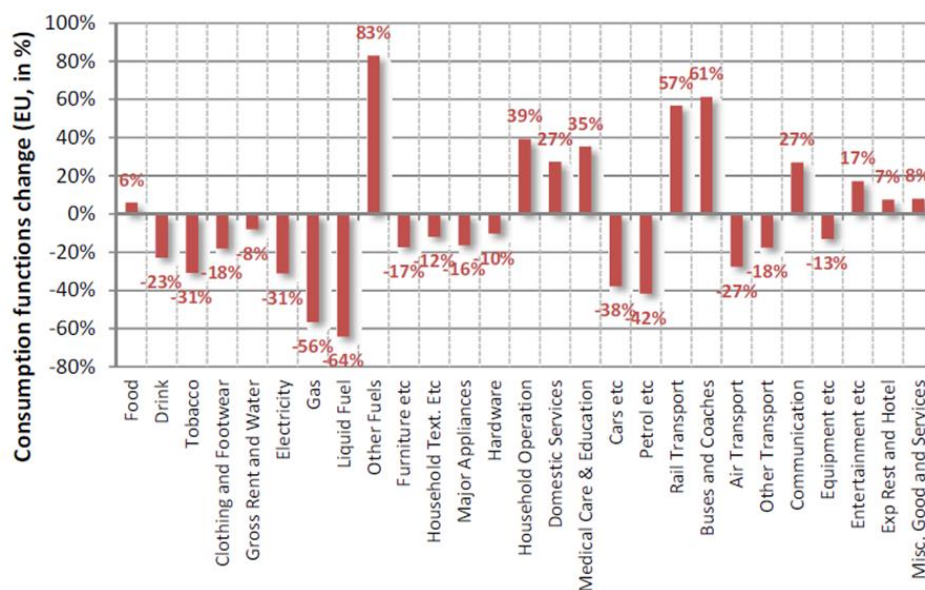


Figure 11 European consumption functions change (%) - Source: NEMESIS model.

At the macroeconomic level in 2050, these behavioural changes and their implementation through a reallocation of the private consumption will lead to a moderated employment creation of about 700,000 and weak GDP gains of 0.5%. Indeed, the shift towards less fossil-fuel energy and more services allows for the reduction of the imports as fossil energies are mainly imported products and as the import rates in the services sectors are lower than in manufacturing industries. However as the services sectors are less progressive, the reallocation of private consumption in favour of these sectors tends to raise the average price of total household consumption. In the “Metamorphosis” scenario, however, this inflationary effect is moderated by the innovation policy putting into action all innovative inputs.

Do these behavioral changes suggest utopia?

The evolution of the utility function and the consequent changes in the budgetary coefficients could seem rather arbitrary. Lancesseur (2015 [13]) tried to deepen the understanding through the application of econometric methods (extended Kalman filter to panel data). He estimates, on the historical evolution of the consumption structure, how much of the consumption structural change was due to pure price and income effects and how much was due to changes in household preferences. The results show an extent very close to our hypothesis for the “Metamorphosis” scenario. Thus, it can justify our choice but it is also a confirmation that the European consumers’ value system is slowly evolving towards an environmental-friendly attitude.

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4.1.2.5 The Environmental challenge

We have analysed how different policy options could contribute to coping with two of the main environmental challenges (resources scarcity and climate change) at the global and EU-27 level and under the two different futures: “Perseverance” and “Metamorphosis”. All the policy options assume there will be a more or less ambitious global climate agreement from the year 2020 onwards, although this does not necessarily mean that the increase in temperature will be maintained below the “dangerous” threshold (i.e. below 2°C). We have quantified the implications of these alternative scenarios in terms of expected temperature change, emissions, resource consumption, technological change, policy costs, etc. From the interpretation of these results, we can extract a set of policy implications.

The emissions pathways from the implementation of the Intended Nationally Determined Contributions are only partly on track with the 2°C target: additional action is needed

The emissions pathway resulting from the achievement of the INDCs under the Perseverance and Metamorphosis scenarios would be only partly on track with the 2°C target. In order to limit the increase in global temperature below the 2°C during the whole century, additional mitigation would be required. Otherwise, the temperature would increase by somewhere in the region of 2.6°C by the year 2100. Up to 2050, the difference between the emissions and temperature change of a scenario with just the INDCs or with additional mitigation from developed countries is quite small. This could discourage additional efforts beyond the Intended Nationally Determined Contributions (INDCs), since the benefits of this mitigation come after 2050. However, it is important to highlight that earlier mitigation can reduce future mitigation costs by, for example, boosting the development of low carbon technologies.

Perseverance and Metamorphosis: Similar is not the same. The results of both storylines in terms of climate mitigation might seem similar for the 2050 horizon and are compatible with different long-term targets. However, these outcomes must be understood in a broader context. The Metamorphosis scenario assumes an anticipatory behaviour and is characterized by a higher GDP growth than the Perseverance, which allows the society to borne the costs of climate mitigation in an easier way in both the medium (up to 2050) and long term (2100).

	GDP growth 2010-2050	GDP pc 2020-50 US\$2014	Cost pc 2020-50 US\$2014	Net GDP pc 2020-50 US\$2014	Cum. CO2 2005-50 GtCO2	Temp. 2050 °C	Temp. 2100 °C
Perseverance	2%	10,773	29	10,744	1,641	1.6	2.6
Metamorphosis	2.7%	13,332	35	13,297	1,666	1.6	2.0

Table 5 Global GDP, mitigation costs, emissions and temperature in the Perseverance and Metamorphosis with full compliance of the INDC and additional mitigation in developing countries to limit temperature increase to 2°C

Note: Both scenarios assume full compliance of the INDC and in the metamorphosis additional mitigation in developing countries in developing countries to limit temperature increase to 2°C; GDP growth: global annual GDP growth rate for the period 2010-2050; GDP pc: global average GDP per capita for the period 2020-2050 in US\$2014; Cost pc: average annual cumulative mitigation cost per capita for the period 2020-2050 in US\$2014; Net GDP pc: global GDP per capita for the period 2005-2050 minus cumulative mitigation costs per capita; Cum. CO2: cumulative CO2 emissions for the period 2005-2050 in gigatonnes of CO2; Temp. 2050: temperature increase by the year 2050 with respect preindustrial levels in °C; Temp. 2100: temperature increase by the year 2100 with respect preindustrial levels in °C.

Temperature increase by 2050 would be over 1.5°C. Even in the scenarios in which the temperature increase by 2100 is limited to 2°C, by 2050 the rise in temperature is expected to be over 1.5°C. The relevance of this result links with the debate of the adequacy of the 2°C target. There is a growing concern in the scientific community on the adequacy of this target and the number of scientists supporting the idea of limiting the temperature increase to 1.5°C is growing. In this sense, the 2°C threshold should be understood as just an upper bound for avoiding dangerous climate change and, therefore, should not be considered as a safe level of warming. In general,

due to the inherent uncertainty of climate change, the consensus position is to push the defense line as low as possible.

Mitigation costs of the INDCs are 2-3 times higher than the cost-efficient mitigation pathway

The abatement costs of accomplishing the INDCs are two to three times higher than the cost-efficient mitigation strategy: the cumulative cost between 2020 and 2050 associated with the INDC scenarios would represent 0.28% of the World's GDP while the cost effective solution would cost 0.10% of the GDP. Under this cost-efficient pathway the responsibility of mitigation would be inverted: developing countries would bear most of the cost while their historical emissions are less than those of developed, although the costs saved by developed countries would exceed the additional mitigation costs in developing countries. Ultimately, the marginal abatement costs are much higher for developed countries than for developing countries. This cost gap suggests that global mitigation costs could be reduced by shifting part of the mitigation effort from developed to developing countries. However, this type of mitigation strategies would not be implemented in the absence of a mechanism for compensation for the developing countries (i.e. climate finance).

A door is open for a 1.5°C threshold. This gap in terms of mitigation costs also represents an opportunity for reducing emission beyond the 2°C target. The total economic resources that developed countries are willing to devote to mitigation (according to their INDCs) could be used to mitigate emissions in a more cost-efficient way and in order to get closer to the 1.5°C threshold.

Chinese target of peaking emissions in 2030 would not be binding. In a context of moderate/high economic growth of the Chinese economy (4.85%/year) and global fossil fuels constraints, the Chinese target of peaking emissions by 2030 would have a very low cumulative cost (US\$ 6 billion, or 0.001% of the GDP). In other words, in the business-as-usual trend emissions would be very close to the "peaking" trend. By the year 2030 China would represent 30% of global CO₂ emissions (283 GtCO₂ for the period 2005-30 and global emission would be 897 GtCO₂). Furthermore, the marginal abatement cost of China is quite low compared to the abatement cost in developed countries. These conditions would allow China to take a more ambitious climate policy than the current INDC

The stringency of climate policies will condition the scope of the low-carbon transition in the EU-27. The future aggregate energy mix of the EU-27 will depend on the level of stringency of the climate policy. In the scenarios in which the EU-27 achieves its INDC, renewables would represent the main energy source (55% of the primary energy consumption), followed by natural gas (29%). However, in this scenario the share of renewables would decrease as the mitigation targets are less ambitious; this reduction would be compensated by an increase in the share of natural gas, coal and, to a lesser extent, oil. Similarly, Carbon capture and storage technologies (CCS) would contribute to reduce the volume of CO₂ released to the atmosphere by the EU-27 by between 30% and 10%.

Potential synergies between facing resources scarcity and climate mitigation. In relation to the challenge of resource scarcity, our results show that, in the absence of proactive policies, resources constraints would likely hit the global economy in the medium to long term. In order to successfully overcome the depletion of fossil fuels the world will have to carry forward a great transition towards a new energy system that will require huge transformations, especially in the transportation sector. These transformations are not very likely to occur within the required time period and on the required scale in the absence of a drastic change in energy policies worldwide.

On the other hand, the policies to address the resource challenge can also represent an opportunity to reinforce other policies. For example, an anticipatory behaviour to oil depletion, combined with a proactive climate policy, could foster the investment in R&D in low carbon technologies and new employment niches.

Oil depletion and climate mitigation will drive a transformation in the transportation sector.

One of the main changes in the energy mix at the global and the EU-27 level is linked to the depletion of oil, which, combined with climate policies, will drive a substitution of this source of energy by other liquids produced from biomass, gas and coal. The increase in the use of biofuels can affect land use and food security. Transportation technologies will also be affected by a reduction in liquid fuel-propelled vehicles, and an increase in hybrid, natural gas fuelled, electric and fuel-cell vehicles.

4.1.2.6 Global Legal Governance

The HiiL team began by developing three main legal and governance scenarios, which offered contrasting but plausible views on how the global legal and governance environment might possibly evolve to 2050. In highly simplified form, the three scenarios present themselves as follows:

The Global Constitution (GC) scenario: a world in which global challenges are predominantly addressed by public bodies, and there is a large measure of co-ordination and integration between the local, national, regional and international levels.

The Legal Internet (LI) scenario: confidence in the ability of transnational and international government-based (including EU) legal and governance mechanisms to address increasingly serious global challenges has been undermined, leading largely to their displacement by global business corporations, global NGOs and transnational civil society, and a vast patchwork of private legal and governance regimes. The Legal Borders (LB) scenario: a world in which countries have turned inward to focus on their own survival strategies and protection of their national interests, so that the legal and governance landscape of the planet is shaped primarily by nation states and a few remaining regional blocs.

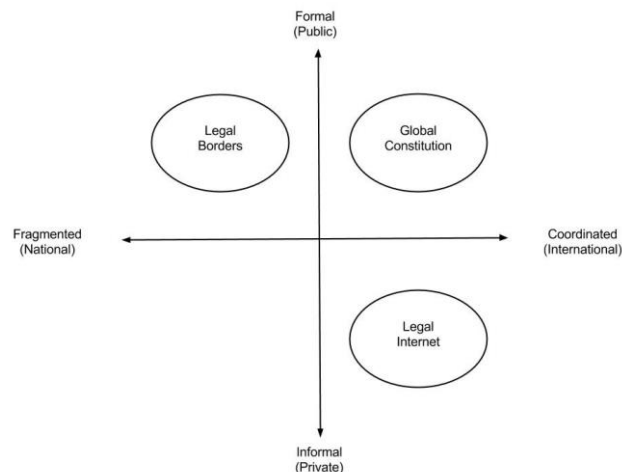


Table 6 the Global legal and governance Scenarios

In order to make the policies and legal instruments more future-proof, the scenarios were complemented by a set of 22 indicators. The scenarios and related indicators form the world's first instrument to monitor and provide advance indications of the directions in which law is unfolding.

The scenarios have been developed to strengthen the robustness of future national and European legal strategies. To this aim, they have been used as a wind tunnel for five EU-relevant policy domains with the aim of generating recommendations directed at improving the existing legal frameworks in these policy areas. The relevance for the EU is self-evident. Since the EU makes up only part of the cast of major actors on the world stage, now and in the foreseeable future, its strategies will depend inter alia on how the great powers and other major regional groupings shape – individually and collectively – the overall governance environment. While hopefully itself playing a major role, its strategic room for manoeuvre will be expanded or constrained in considerable measure by the actions of others. Hence, whether the EU is operating in a world of GC, LI or LB will have a determining influence on the policy approaches it can design and effectively implement.

Hence, in a first step, a range of specific policy domains were run through each of the three main HiiL scenarios in order to ascertain how a given global governance context might influence policy strategies, tools and outcomes. Five policy domains were chosen: Cyber Security; Space Debris Mitigation; Electric Vehicle Infrastructure Development; Bio-refinery Development; and Families in Transition.

The policy domains were selected to reflect a wide range of global challenges that Europe and the rest of the world will face in the coming decades; a variety of different policy-making levels from

global to local; and differing degrees of global interdependence. This is presented in schematic form below.

<i>Grand challenges</i>	<i>Illustrative policy area</i>	<i>Current spatial dimension of policy-making</i>	<i>Degree of global interdependence</i>
Resource scarcity	Smart specialisation: Bio-refinery clusters	Sub-national/national	Low
Environment/pollution	Electric vehicle infrastructure	National	Low-medium
Global security	Space debris Cyber security	National to international	High High
Inequality	Family policy	Mainly national	Low

Table 7 The policy area, the spatial dimension of the policy making and the degree of global interdependence

It is worth recalling at this juncture that scenarios are stylised images of potential futures and do not aim at predicting nor expressing desirable outcomes. The review of the five policy areas was not intended to provide a detailed and comprehensive view of the implications and challenges of each scenario, but rather to identify how differences in global governance contexts may generate differences in policy approach. In a second step, the results of the first step were crossed with the two FLAGSHIP storylines, Perseverance and Metamorphosis, in order to assess what the possible implications for the storylines might be. We have refrained from setting out specific policy considerations for each of the five policy domains in any detail. The reason for this is that each of the policy domains treated here is vast and complex in its own right. Brief (40 to 80-page) analyses of their probable future trajectories cannot possibly do justice to the intricacies of policy-making in their respective areas, but they can give us a sense of the direction in which policy-making in general might go.

Hence the main headline findings are presented as a kind of meta-analysis of the five case studies with respect to their potential impact on the realisation of the visions embodied in the FLAGSHIP storylines – and therefore of the most important conclusions that policy-makers in general, and European policy-makers in particular, would need to bear in mind. In very brief form, these can be summarised as follows:

1. The report demonstrates that the global legal and governance environment is a critical factor in determining the policy approaches that would be adopted in the Flagship storylines Perseverance and Metamorphosis. Each scenario would pose distinctly different challenges to policy-makers.
2. The influence and configuration of the principal actors shaping and driving policy differ in each scenario, which in turn heavily affects the thrust of the policy recommendations that would be made.
3. In particular, the policy reviews suggest that the fundamental role of policy-makers in the Global Governance and Legal Internet scenarios is very different. In the former, policy-makers have an active role in the preparation, design and implementation of policies, while in the latter policy-makers' role is in many cases reduced to that of regulator and facilitator.
4. This raises the question of the importance of a minimally effective role of the state, since it applies in particular to the Legal Internet combinations with both Metamorphosis and Perseverance. For either storyline to "function", it seems reasonable to expect a stable, transparent and predictable regulatory framework to be in place. This is less easily conceivable under the auspices of a multitude of stakeholders from business, civil society and various other walks of life.
5. On the whole, the policy outcomes of both Perseverance and Metamorphosis are improved if they evolve in a Global Governance context. This is largely because Global Constitution assumes a world of strong state-led international cooperation and effective joining up of the global, international, national and local levels of governance, which chimes well with the nature of the global challenges reviewed and the need to implement solutions at the local level. Here, policies will tend to be harmonised, consensual and backed by international legitimacy. Legal Internet and Legal Borders, on the other hand, tend to lead to less optimal outcomes. The challenges here

range from the lack of accountability and legitimacy from its policy-making entities in Legal Internet to the lack of international cooperation as a serious impediment to economic growth in Legal Borders.

6. Crucial to the success of the Metamorphosis vision is a fundamental change of values, attitudes and behaviour. Even when largely brought about by educational and informational efforts, this might still be perceived as a *deus ex machina* phenomenon. It should be borne in mind, however, that the appropriate design of policies can also act as a very concrete stimulus to attitudinal and behavioural change.

4.1.2.7 Territorial Governance

Grand Societal Challenges affect the development opportunities and challenges of European regions and cities. Europe's territorial diversity thus needs to be taken into account when studying the impact of Grand Societal Challenges. The analysis of territorial differentiations of European cities and regions towards Grand Societal Challenges is discussed for four themes and presented in four indicative maps. They are based on Territorial Impact Assessment (TIA). The TIA approach assesses the exposure and sensitivity based on quantitative and qualitative information and reflects the current territorial impact of the selected Grand Societal Challenges.

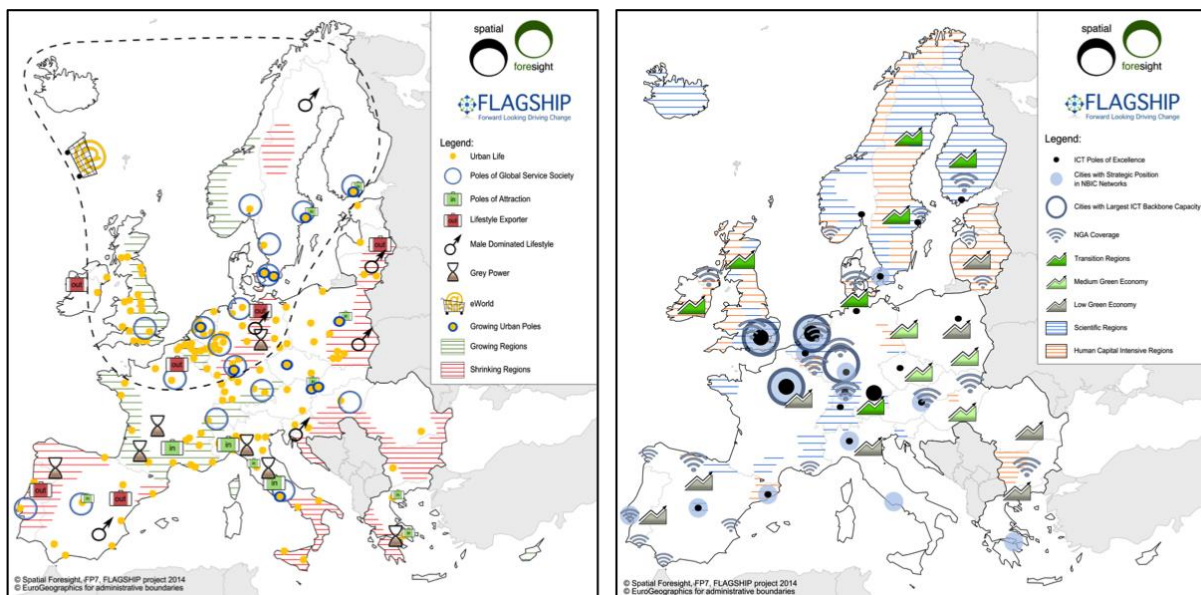


Figure 12 Grand Societal Challenges in a territorial overview Socio-demographic development in Europe and Knowledge & Technology in Europe

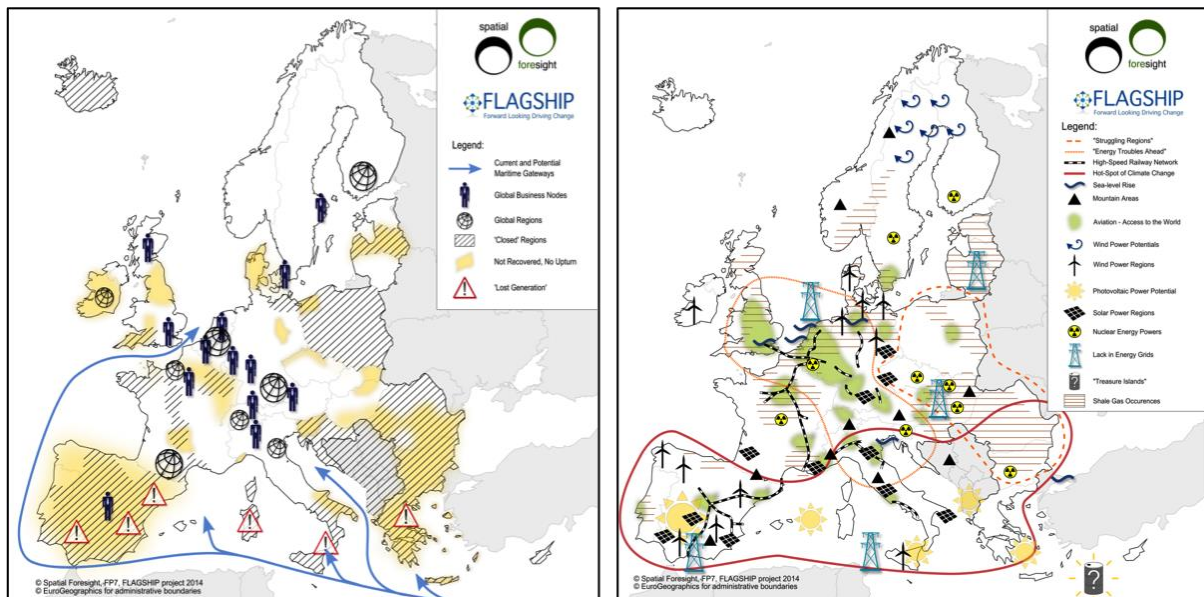


Figure 13 Grand Societal Challenges in a territorial overview: Goods & Services in Europe and Energy & Environment in Europe

Socio-demographic development

Social Grand Societal Challenges have their impact on territories as people and their behaviour shape socio-economic and environmental characteristics of regions and cities. At the same time, territories affect people, for example the settlement structure or urbanisation can change people's lifestyle. Urban centres in Europe are in particular exposed and sensitive to these social challenges. Northwest Europe and several cities that are not located in this European core can be classified as poles of attraction. Urban regions need an on-going inflow of new and innovative ideas in order to maintain their role as places where the new urban vibe can further develop.

Knowledge and technology

Grand Societal Challenges under the topic of knowledge and technology show increasing diversity across Europe. ICT, innovation and research are believed to strengthen Europe's growth and capacity but human capital and tacit knowledge is unevenly distributed. It becomes clear that regions with above the European average human capital endowment and scientific knowledge performance are mostly concentrated in the Nordic countries but can also be observed in other parts of Europe, including Switzerland, Southern Germany and Scotland in the UK. With regards to ICT, Europe's poles of excellence are geographically concentrated around major metropolitan areas. However, small- and medium-sized cities also play a key role in fostering competitiveness and growth through ICT.

Energy and environment

The impacts of environmental trends vary across Europe, mostly depending on the physical characteristics of the region in question. This gives a diverse picture for this topic, with specific challenges and opportunities for different regions across Europe. The uneven distribution between energy supply and demand has to be balanced and implies a need for grids and storage systems so that energy can be made available anytime and anywhere. The sensitivity of regions to climate change relies to a large extent on the regions' and cities' capacities to adapt to climate change. Furthermore, regional specificities, such as the presence of mountains, rivers or coastal areas and land-use, influence the territorial impact of climate change.

Goods and services

Existing territorial characteristics and assets, e.g. accessibility, economic conditions or innovation, partially determine economic development potential. The financial crisis has had a strong impact in many parts of society and risks to increase structural gaps and territorial polarisation. Furthermore, Europe's neighbourhood is changing. Europe has to compete more with new emerging markets,

the geopolitics in the Arctic region are shifting and the Gulf States are emerging as new centres of economic and political power. Europe's metropolitan areas are gateways of Europe's global position. These include not only urban areas in Europe's core, but also capital regions and second-tier cities in the periphery.

Two conclusions

Exposure and sensitivity of European cities and regions and, consequently, also the impacts of Grand Societal Challenges vary considerably across the European territory. The analysis presented does not provide a final result but is mainly seen as an input to discussions on European diversity when it comes to Grand Societal Challenges.

Europe needs policy and governance responses, which are tailor-made. This poses two principle challenges towards EU regional policy. On the one hand, there is the perceived need to focus on economic recovery and growth, as advocated by the Europe 2020 Strategy. On the other hand, there is a need to pay attention to the particular development potentials and challenges of each single region and city, and thus consider territorial diversity, as well as to explore alternatives to mainstream growth agendas (as discussed in the 'metamorphosis' scenario below).

Two scenarios

The impacts of Grand Societal Challenges vary considerably across the European territory. Europe therefore needs policy and governance responses, which are tailor-made, and territorial diversity needs to be taken into consideration for policy-making. Hence, it is worth discussing interdependencies between Grand Societal Challenges and territorial governance. This allows us to reach conclusions on how territorial governance can contribute to improving Europe's ability to better cope with the main challenges.

Towards Perseverance – Where do we go from here?



Figure 14 Core-periphery patterns

With regard to territorial development, technological innovation will be the key driver of change. The following key developments are furthermore to be expected:

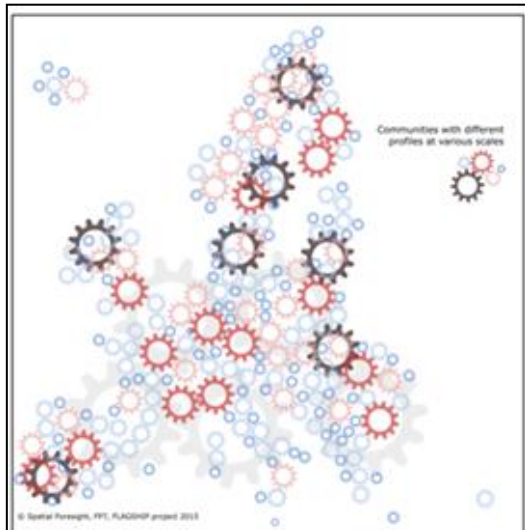
- *The increasing gap between urban and rural areas*, driven by the shrinking and ageing processes, which affect rural regions in particular, will challenge the European social model and national welfare systems.
- *Stronger core-periphery patterns*, driven by concentration processes in agglomeration areas (see map) and the loss of capital, resources and population in the periphery.
- *Territorial integration and disintegration*, driven by centripetal and centrifugal forces. These contradictory trends will challenge economic, social and territorial cohesion and lead to additional imbalances and an even stronger core-periphery pattern.

These three trends pose challenges not only to EU sectoral policies and the idea of European cohesion, but also to governance arrangements and governance processes between the players involved. With regard to territorial governance, some key rationales related to governance will not change. Public authorities will remain key players and hold the ultimate power of decision. In doing so, governmental entities will furthermore remain sector-oriented and have a clear focus on specific territorial levels. This also implies that spaces of intervention will still correspond to political and administrative jurisdictions.

On the one hand, shifts in power can be seen within the European multi-level governance system, resulting from the centralisation and decentralisation of power. Following the key rationale of subsidiarity, the most important shift refers to national competences that will be transferred either to the regional or European levels. This also includes the participation of non-public sector players.

The influence of private sector players will increase because they can provide the necessary resources, such as expert knowledge or financial means. Policy-making will consequently become more similar to public management. The involvement of other non-public players will increase, yet mainly for formal reasons, basically to avoid long-term legal conflicts.

Towards Metamorphosis – Where do we go from here?



With regard to territorial development, technological innovation will be an important driver of change. In addition, a socio-ecological and behavioural paradigm shift will be the key change. Top-down stimulus and bottom-up requests for change will lead to new approaches and the empowerment of various players. Social capital will be used as the main resource in the development of new approaches to cope with demographic change. With regard to ICT, new networks will allow for more active involvement of rural areas in related RTDI activities based upon location-independent networks. Economic growth will be decoupled from the consumption of resources and be based upon closed-loop lifecycles. In the field of economic development, regions will be more integrated on various scales – depending on the specific context (see map). New approaches that build on territorial capital will allow for micro-scale experimentation.

Figure 15 Core-periphery patterns

With regard to territorial governance arrangements, considerable changes will take place. Real co-decision-making processes will replace the final decision power of public authorities. Strict territorial levels will be replaced with more holistic and functional approaches. Local and regional communities will become increasingly self-organised. On the European level, a new “Local and Regional Council” consisting of representatives from strategic coalitions as well as local and regional communities will be a main player and will bridge the gap between the local, regional and European scale.

Conclusions

In both visions there is a shift in decision-making powers from the national level towards a) large framework-like decision-making at the international level, and at the same time towards b) more small-scale decision-making at the local and regional levels. The four most pressing developments are demographic change, climate change, major infrastructure/technological shifts and the need to find a new economic model.

No new set of policies is necessary. It is more important to adjust and redesign policies, leaving scope to test new approaches, as often it is the details that influence future impacts. One such policy field that addresses different challenges and could generally allow for a wide range of approaches is EU Cohesion Policy:

- *Binding local and European responses.* As small single territories are not viable, there is a need to keep Europe together and have an approach to solidarity.
- *European-wide investment programmes.* The nation state is getting weaker and decisions about large-scale networks need to be made at the European level.
- *Community-led local development.* Lower levels of governance are becoming stronger and need to take responsibility for finding truly place-based solutions.
- *Thematic objectives.* There are six major areas that need to be addressed: demographic change, climate change, new economic and societal models, energy production, consumption and networks, ICT, and transport solutions and networks.
- *Encouraging experimental developments.* When it comes to future socio-economic development, local and regional solutions need to be developed and tested.

4.1.3 The potential impact and the main dissemination activities and exploitation of results

FLAGSHIP primarily aims at the development of innovative approaches to devise and assess future visions of a sustainable Europe. The main expected impact was therefore the enhancement and improvement of the scientific body of knowledge required for the above developments. Accordingly, the project has strived to ensure that its results are:

- Innovative, in that they substantially add to the current state of the art
- Policy relevant, in that they can provide usable inputs to the assessment of current EU policies and to the formulation and monitoring of future policies
- Potentially relevant for society as a whole, in that the implementation of the sustainable policies devised in the project can be concretely expected to improve the quality of life of European citizens
- Widely diffused and discussed among the scientific community, policy makers and stakeholders involved in the formulation and/or implementation of sustainable policies.

The highly innovative and exploratory nature of the research work featured in the project implies that many of the project impacts should be considered as indirect (or potential), in the sense that their concrete materialisation and, all the more, their measurement, is only possible if the scientific innovation produced by FLAGSHIP is validated and concretely applied in the formulation of original policies at the local, national, regional and European level.

Such limitation is clearly intrinsic to the nature and scope of the task as defined in the Workprogramme, and it would therefore be unrealistic - and scientifically not credible - to claim that the successful implementation of FLAGSHIP will per se generate e.g. improvements in the quality of life of European citizens, or a directly measurable reduction of GHG emissions, etc.

Impact on RTD Community

The general subject of medium/long term sustainability of the European economy and society has been in focus in a number of research projects, many of which funded within EU Framework Programmes, and most of the FLAGSHIP partners have in fact played a prominent role in such efforts. While the progress thus achieved in recent years is tangible, it is commonly recognised that the current body of scientific knowledge can hardly be considered as definitive when it comes to providing decisive input to policy formulation, or even to a robust representation of possible futures. The main reasons behind this include:

- the very complexity of the subject, which inevitably calls for sophisticated methods and tools, but also for the means to validate their robustness (simplified representations, case studies)
- the historical tendency to look at the future as the continuation of the past, and the well-known difficulties (both conceptual and methodological) to devise possible futures that incorporate discontinuities (e.g. the paradigm shifts in focus in this project)
- the (relatively) recent recognition of the unsustainability of current paradigms (fossil energies, private motorization, urban sprawl, man-made accelerated depletion of natural resources), and of critical trade offs between those, whereby an insufficient assessment capability may lead to major policy uncertainties.

FLAGSHIP has generated direct impacts on the RTD community by:

- Ensuring major advancements in the modelling tools adopted so far and, at least as importantly, assessing their comparative merits and limitations through a comparative review of their performances, in order to reach conclusions on the robustness of the modelling approaches and propose a roadmap for the eventual integration between different modelling platforms
- Applying the new approaches and models to specific, concrete case studies, in order to validate them

- In general, making the most of the high level of multidisciplinary featured by the Consortium, particularly with a view to "think out of the box" when developing new visions of the future and the associated methodological approaches.

Contribution to EU policies

It is increasingly difficult to find a single policy document issued by the EU that does not, directly or indirectly, refer to the ultimate goal of sustainability. This is due to the combination of the increased awareness of the sustainability implications of policy making at all levels, and of the improved capability of assessing the causal links between e.g. sectorial developments and the main indicators of sustainability (economic, environmental, societal).

Ultimately, one can therefore claim that FLAGSHIP, inasmuch as it has succeeded in shedding new light on the qualitative and quantitative effects of policies that explicitly target a forceful transition towards increased sustainability of the European society, may contribute to the formulation, monitoring and assessment of all major EU policies, particularly in the following EU policies/policy areas:

- The EU R&D policy. FLAGSHIP has introduced an innovative formulation of R&D policies: in the Metamorphosis scenario, R&D investments are not considered as an indifferentiated bulk, but are articulated in "traditional R&D spending", ICT-related innovation spending and investment in intangible capital (software, training etc.). The simulation of such innovative approach to allocating R&D spending shows that the differentiated approach has several merits, notably including (i) a faster and better achievement of R&D intensity targets, and (ii) a better convergence across member states (and therefore more inclusiveness)
- EU environmental policies, notably for what concerns the achievement of GHG reduction targets, as e.g. resulting from the COP21 agreements. The simulations carried out in FLAGSHIP show that, while the achievement of the targets at 2030 is feasible in both the perseverance and the metamorphosis scenarios, the latter performs better in the longer term (2050) and, even more importantly, it entails a higher net increase of GDP/capita, once mitigation costs are deducted.

Impact on society at large

FLAGSHIP helps formulate more effective sustainable policies, which will in turn reflect on all the indicators of well-being. More specifically, devising optimal pathways of transition towards a more sustainable society requires the participation, or at least the acceptance of citizens. Such acceptance can only be gained if the information made available to the public is scientifically credible and appropriately diffused. Although FLAGSHIP does not explicitly feature dissemination activities that are exclusively and directly targeting the public at large, it has generated abundant evidence to this effect that could be exploited in other projects focusing on the science and society link.

Main dissemination activities and FLAGSHIP web-site

The outcomes of FLAGSHIP have been and are being disseminated in the scientific and stakeholders community by means of dissemination tools (web-site..) and other dissemination activities.

- **FLAGSHIP Website:** <http://flagship-project.eu/what-is-flagship/> (Home page below)



PROJECT OVERVIEW

FLAGSHIP is an FP7 project, funded by the European Commission (DG RESEARCH) under the "Socio-Economic Sciences and Humanities" theme, with the aim of developing a "Forward Looking Analysis of Grand Societal Challenges and Innovative Policies".

The FLAGSHIP project thus aims at **driving change**, supporting the policy shift from adapting to changes through short-term policy responses, towards anticipating, welcoming and managing changes properly.

The FLAGSHIP project brings together a multidisciplinary team with recognised records of excellence in qualitative and



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- **FLAGSHIP logo**



- **FLAGSHIP contact list**

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4.2 Use and dissemination of foreground

4.2.1 Continuing collaboration/exchange among partners

The FLAGSHIP consortium includes 16 partners representing universities, public research institutions, private research and consultancy firms. It also features a rich mix of thematic expertise (economics, energy and environment, transport, landuse, agriculture, demography), and covers both qualitative and quantitative approaches to future studies, and their integration. One of the challenges of the project was to ensure smooth and fruitful collaboration within such a diversified group, and having achieved this goal throughout the project lifetime, it is now the firm intention of the participants to further consolidate and exploit this highly multidisciplinary experience. Accordingly, the FLAGSHIP partners intend to pursue further collaboration opportunities, both within the formal framework of future research projects and through the day by day maintenance of contacts and exchanges.

4.2.2 Dissemination of existing materials (deliverables newsletters etc.)

FLAGSHIP has produced abundant output materials, covering the full range of typologies, including scientific Deliverables, newsletters, policy briefs as well as Project factsheet, Project poster, Project 8-page brochure and power point presentations prepared for the various project events throughout its lifetime. The FLAGSHIP brochure especially has been updated in 2015 in order to include the latest project developments.

These materials illustrate the innovative approaches and the original outcomes of the project and as such their interest extends well beyond the simple account of the project results. They represent the most immediately tangible product of FLAGSHIP and it is therefore planned to continue distributing them through all possible channels, including active ones such as their physical handout (notably of newsletters and policy briefs) at targeted events.

4.2.3 Website

FLAGSHIP 2.0 website was set up in February 2013 representing an easy to use and content oriented tool devoted to ensure the largest project impact and dissemination, and linking to the FLAGSHIP social media. The FLAGSHIP web-site was then completely redesigned and relaunched again in March 2015; the old version of the website has been kept online until the new one was ready to be published, guaranteeing the continuity of the project online presence. The redesign objectives were to make the website i) easier to navigate ii) more contemporary and appealing to users. It has four main sections accessible (together with their subsections) from the header menu: *Events and Workshops*, *Newsroom*, *About*, *Public resources*, and an additional one introducing the project in a nutshell, *What is FLAGSHIP*. The website includes relevant multimedia content and informative pages, clearly describing the concepts, objectives and achievements of the FLAGSHIP project.

4.2.4 The FLAGSHIP Virtual library and you tube videos

Modern visions of the World, and its future, either expressed in political visions, in literary fictions or popular movies, are embedded into variations and recombination of the myths shared by all human cultural traditions. Scientific analysis and social predictions are made by applying theories based on the best understanding of past events, but are always derived from our intuitions and prejudices. In the context of WP3 - Task 3.3, MCRIT researched recurrent themes and myths in movies, whereas University of Porto did a parallel task with literary works (mostly books). Based on the outcomes of WP3, MCRIT created in WP9 a website portal (http://81.47.175.201/flagship_visions/) containing trailers of all movies discussed in WP3, classified according to the 8 identified main themes linked to different societal passages or transitions (during spring 2013). Then, based on such imageries, MCRIT generated a set of videos, each one illustrating a different myth or societal transition (about 1 minute long each). First draft videos became available in M6 - June 2013 at the time of the Ventotene workshop, and based on

internal discussion, all others were produced during fall and winter 2013-2014. In Spring 2014, videos were uploaded in the Flagship Myths website and directly linked by SIGMA to the FLAGSHIP website and promoted in FLAGSHIP social media.

4.2.5 The social media strategy and action plan

The social media strategy and action plan led to an exponential increase of the project followers on [Twitter](#) (194 at M36 against 58 at M18) and a growth in the number of the [LinkedIn](#) group members (102 at M36 against 89 at M18). A [YouTube](#) channel was created in December 2014 and organised in thematic playlists (299 minutes of views) incorporating the videos presented in the FLAGSHIP Visions portal.

4.2.6 Webinars.

Two [online meetings](#) have been organised in December 2014 and June 2015 to get feedback from a focused group of stakeholders. The first FLAGSHIP Webinar, *Looking beyond to a Sustainable and Desirable World* took place on the 5th December 2014 and gathered 17 attendees. The second FLAGSHIP webinar, *EU Governance Challenges* took place on the 16th June 2015. The webinar presented the upcoming Policy Brief, with a focus on legal, territorial and EU governance and their evolution in the two opposed visions for the future proposed by FLAGSHIP (metamorphosis and perseverance). Both webinars are documented on the website and led to further discussions via email between partners and third parties.

4.2.7 Direct input to other research

The Agent-based model (ABM) developed in WP5 of Flagship comprises a discrete-choice formulation of an investment decision into different types of technology in the electricity-sector. A core element of the model is agents' choice between different investment strategies - namely a (cheap) heuristic strategy and a (costly) rational strategy. The choice of strategy is made based on a comparison on the relative benefits of the strategies.

The Flagship ABM has served as basis for and has been further developed under an internal project at TNO. The ABM developed under this project also drew heavily on the material on circular economy discussed in Flagship. This modified version of the ABM depicts a discrete choice similar to that of the ABM developed in Flagship, where agents choose between investing in a circular and a conventional version of a good. Also here agent-specific preferences and choice of strategies are important for the final outcome of the model.

The model has also been applied to two use cases related to circular economy: rubber tires and repurposing/recycling of batteries, being discussed with companies such as Michelin and VDL. As such, the development of the ABM in Flagship, based on a rather general formulation, was crucial as a starting point for more specific applications of a similar model.

4.2.8 Presentations and publications

As the natural continuation of the activities carried out during the project lifetime, the partners of FLAGSHIP are committed to making the most of all opportunities to present, illustrate and discuss the project outcomes, notably in view of triggering further research developments and policy support applications.