The **CLIMSAVE** project

Climate Change Integrated Assessment Methodology for Cross-Sectoral Adaptation and Vulnerability in Europe

Report on the first CLIMSAVE European stakeholder workshop

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Introduction

Participatory scenario development processes have played an increasingly significant role in major climate change and environmental studies over the past few decades and already play a crucial role in adaptation assessment by providing a glimpse of the different socio-economic trends that will form the back-drop to long term adaptation measures. Moreover, planning an adaptation measure will have to take into account the uncertainty of future climate impacts, and participatory scenarios are a useful method for incorporating this uncertainty into decision-making.

CLIMSAVE will advance the state-of-the-art in participatory scenario development and analysis, especially for climate impact and adaptation assessment, by developing a new and innovative methodology for participatory scenario development and analysis specifically geared towards interactive climate impact and adaptation assessment. This new methodology will include: [1]

- A careful stakeholder selection procedure;
- Kick-starting the scenario process;
- Developing integrated and dynamic stories focusing on socio-economic elements;
- Using fuzzy sets to quantify model parameters; and
- Producing multiple products to improve communication.

The composition of the stakeholder panel for the CLIMSAVE European case study was carefully put together on the basis of a newly developed methodology. The careful selection of stakeholders for a participatory scenario development process such as undertaken in CLIMSAVE is an important factor in the exploration of plausible futures, as the inclusion of perspectives from stakeholders provides not only important information for the process and research conducted in CLIMSAVE, but also creates potential for higher relevance of the process results for stakeholders.

CLIMSAVE scenarios are being developed up to the 2050s, with an intermediate time slice in the 2020s. The time horizon of 2055 is sufficient to include the impacts of climate change and the effect of (some of) the adaptation options. The methodology will be developed for the European case study and tested in a regional case study. Within CLIMSAVE, Scotland acts as the regional case study.

This deliverable reports on the results of the first European CLIMSAVE workshop. The first European CLIMSAVE workshop was organised in Bruges on 10-12 May 2011.

[1] A more detailed explanation of the scenario methodology and stakeholder selection process is given in Kok et al. (2011). Report on the new methodology for scenarios analysis, including guidelines for its implementation and based on an assessment of past scenario exercises. Available from www.climsave.eu.

1. Overview of the workshop

Below is a summary of the activities that took place during the two-day workshop for the European CLIMSAVE case study. A detailed agenda can be found in Annex I. A list of participants can be found in Annex II.

Day 1:
The first day of the workshop started by giving stakeholders the opportunity to get to know each other, the CLIMSAVE research team and by providing stakeholders with the necessary background information. Presentations were given on:

- Introduction to CLIMSAVE by Dr. Paula Harrison, University of Oxford;
- CLIMSAVE input to policy processes by Dr. Wolfram Schrimpf, DG Research and Innovation, European Commission;
- The future scenario development methodology by Dr. Marc Gramberger, Prospex.

Following these presentations, the scenario development process started with a plenary discussion on drivers, certainties and uncertainties on the basis of a candidate list of uncertainties and drivers.

Day 2:
On the morning of day two, discussions on the drivers, certainties and uncertainties continued and led to a revised list of drivers and uncertainties. This revised list of drivers and uncertainties was then put to the vote to determine the most important and at the same time most uncertain drivers.

The outcome of the voting was then used to establish in plenary the scenario logic. Next, the stakeholder panel characterised the scenario logic by attributing main characteristics to each quadrant of the scenario logic. For the remainder of day two the stakeholder panel was divided into four groups, with each group developing scenario elements and dynamics for their assigned quadrant of the scenario logic. These elements and dynamics fed into the development of preliminary scenario storylines. A professional facilitator and a content supporter from the CLIMSAVE research team assisted each group.

At the end of day two, each group presented the scenario they developed in plenary to the rest of the stakeholder panel and the CLIMSAVE research team. Feedback was given on each of the storylines to help refine them further.

Day 3:
At the beginning of day three the panellists spent some time refining their storylines. Following this, the stakeholder panel was asked to quantify a number of statements.

The quantification exercise consisted of a group exercise and an individual exercise. During the group exercise, each scenario group was asked to make qualitative statements about changes in a set number of variables in line with the storyline the group had developed. In the individual exercise each stakeholder was asked to quantify what they meant by the qualitative statements in the group exercise.

Following the quantification exercise, Dr. Ian Holman (University of Cranfield) presented a mock-up version of the Integrated Assessment Platform and explained the importance and role of the scenarios for the development of the Platform.

The workshop drew to a close by explaining to the stakeholder panel what will happen in the second workshop. This workshop will be held in Prague, on 6-8 February 2012.

2. Identification of main certainties and uncertainties

2.1. The process

The process of developing future scenarios on climate change adaptation within the CLIMSAVE project makes use of a so-called "kick-start" approach to identify the main uncertainties and drivers. These drivers, together with their main uncertainties, form a long list out of which two drivers, together with their uncertainties, were combined to establish the scenario logic.

The kick-start approach consists of the following steps:

1. Research was conducted by CLIMSAVE on the main drivers and uncertainties used in other scenario exercises or research projects to establish a similar list of main drivers and uncertainties. For the European case study the following sources were consulted:

    - European Environment Agency (2011). The European Environment, state and outlook 2010. Assessment of global megatrends. EEA, Luxembourg, Publications Office of the European Union.
    - European Environment Agency (2011). The European Environment, state and outlook 2010. European environment synthesis. EEA, Luxembourg, Publications Office of the European Union.
    - Schwarz, M. & Thompson, M. (1990). Divided we stand: redefining politics, technology and social choice. London, Harvester Wheatsheaf.

2. On the basis of this research, CLIMSAVE established a list of 15 candidate drivers and main uncertainties. The list of candidate drivers (including definition and main uncertainties) can be found in Annex III.

3. The list of 15 candidate drivers together with their main uncertainties was presented to the stakeholder panel at the start of the workshop.

4. At the workshop, the stakeholder panel was asked to review the candidate list and propose amendments to it.

CLIMSAVE opted for this fast track approach for a number of reasons:

- It makes it possible to concentrate most of the workshop effort on the actual development of the scenario logic and scenario storylines;
- It makes the most of the opportunity to work with stakeholders; and
- It makes use of existing research.

In general, the European Stakeholders struggled with this fast track approach. This can be partly explained by their broad geographical spread (compared to the Regional scale), the diversity of the stakeholder panel, as well as the unfamiliarity of the stakeholders with the sources used to draw up the list of uncertainties.

2.2. The outcome

After having had the opportunity to revise the list of candidate uncertainties, the stakeholders jointly decided to reduce the list of 15 drivers to 14 drivers (Table 1). The following drivers were eliminated, modified, added or merged with other drivers from the list in comparison to the original list[2]:

- The driver "System shocks" was eliminated.
- Technological development was further refined into the driver "Solutions by innovation to depletion of natural resources". The uncertainties associated with this driver were defined as "non-effective to effective".
- Social behaviour was eliminated in favour of the newly introduced driver "Social cohesion".
- The driver "Ability of natural systems to deliver ecosystem services" replaced "Response of natural systems".
- Environmental regulation was eliminated and became part of the driver "Decision-making level". The uncertainties associated with the "decision-making level" driver were also updated to four uncertainties (international dominant, Europe dominant, Nation-state dominant, local dominant).
- "Impact of climate change on human society" was further refined to "Impact of climate change and other natural hazards". Its uncertainties were changed from "low to high" to "fragile and unstable to resilient and stable".
- "Attitude towards nature" was further refined to "Attitude towards human and natural health". The uncertainties were changed from "instrumental to respect" to "influential to respectful".
- "Social Belief systems" was added to the list. Its uncertainties were defined as "plural to dominant".

The table below shows the final list of drivers and uncertainties.

[2] The original list of candidate drivers (including definition and main uncertainties) can be found in Annex 3.

Table 1: Main drivers related to climate change adaptation in Europe and the main uncertainties as identified and agreed by the European stakeholder panel.

Europe dominant	International dominant Decision-making level Local dominant	Nation-state dominant
Low Stability	Geopolitical stability	High stability
Strong cooperation	International cooperation	Weak cooperation
Low responsibility	Social and environmental respect of non-state actors	High responsibility
Migration within regions	Population and migration	Migration between regions
Gradual	Economic development (growth)	Roller-coaster
Unconstrained	Globalisation	Constrained
Restricted	Choice	Free
Influential	Attitude towards human and natural health	Respectful
Low	Social cohesion	High
Non-effective	Solutions by innovation to depletion of natural resources	Effective
Plural	Social belief systems	Dominant
Fragile and unstable	Ability of natural system to deliver ecosystem services	Resilient and stable
Low	Impact of climate change and other natural hazards	High

2.3. Voting on level of importance and uncertainty

Stakeholders ranked the drivers and uncertainties in terms of the degree of importance and the degree of uncertainty through a voting procedure in which stakeholders were asked to vote on what for them were the most important and most uncertain factors (Table 2). Those key driving forces that scored highly on importance and uncertainty were examined further to assess their suitability for serving as key drivers to establish the scenario logic.

Table 2: Results of voting on level of importance and uncertainty of drivers by stakeholders.

		Importance	Uncertainty
1	Decision-making level	3	0
2	Geopolitical stability	2	0
3	International cooperation	1	1
4	Social and environmental respect of non-state actors	1	0
5	Population and migration	3	2
6	Economic development	10	11
7	Globalisation	1	0
8	Choice	0	0
9	Attitude towards human and natural health	4	4
10	Social cohesion	3	2
11	Solutions by innovation to depletion of natural resources	7	8
12	Social belief systems	2	3
13	Ability of natural system to deliver ecosystem services	7	11
14	Impact of climate change and other natural hazards	4	8

3. Scenario logic and key characteristics of each scenario

3.1. Scenario logic and characteristics

Following the voting and ranking, a number of attempts[3] to combine two different drivers were made to establish the final scenario logic. The driver "Economic development" clearly came out as one that is according to the European stakeholder panel both highly important as well as highly unsure in Europe. This driver was paired with "Solutions by innovation to

[3] The following attempts to pair two drivers were unsuccessful:

- Ability of natural systems to deliver ecosystem services vs. Solutions by innovation to depletion of natural resources;
- Ability of natural systems to deliver ecosystem services vs. Economic development;
- Economic development vs. Attitude towards human and natural health;
- Solutions by innovation to depletion of natural resources vs. Impact of climate change and other natural hazards.

depletion of natural resources", which also scored high (albeit less outspoken), on uncertainty and importance. The stakeholder panel unanimously decided to use these two drivers as axis for the scenario logic and hence the development of scenarios for Europe.

Stakeholders also characterised each of the four quadrants. The key characteristics of each scenario can be found in Figure 1.

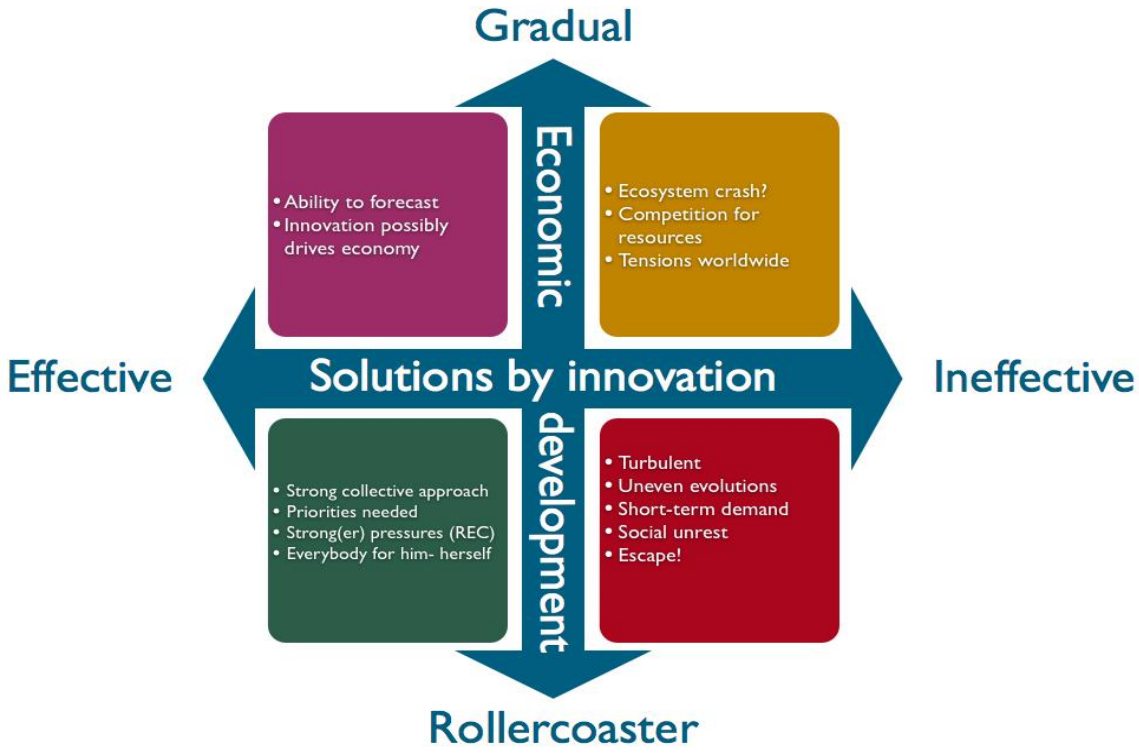


Figure 1: Scenario logic, together with key characteristics for each quadrant of the scenario logic.

3.2. The Scenarios

The European case study is developing four scenarios:

- *We are the world* is characterised by gradual economic development and effective solutions by innovation to the depletion of natural resources.
- *Icarus* is characterised by gradual economic development and ineffective solutions by innovation to the depletion of natural resources.
- *Rollercoaster to Armageddon* is characterised by a rollercoaster of economic development and ineffective solutions by innovation to the depletion of natural resources.
- *I-Ticket to Ride* is characterised by a rollercoaster of economic development and effective solutions by innovation to the depletion of natural resources.

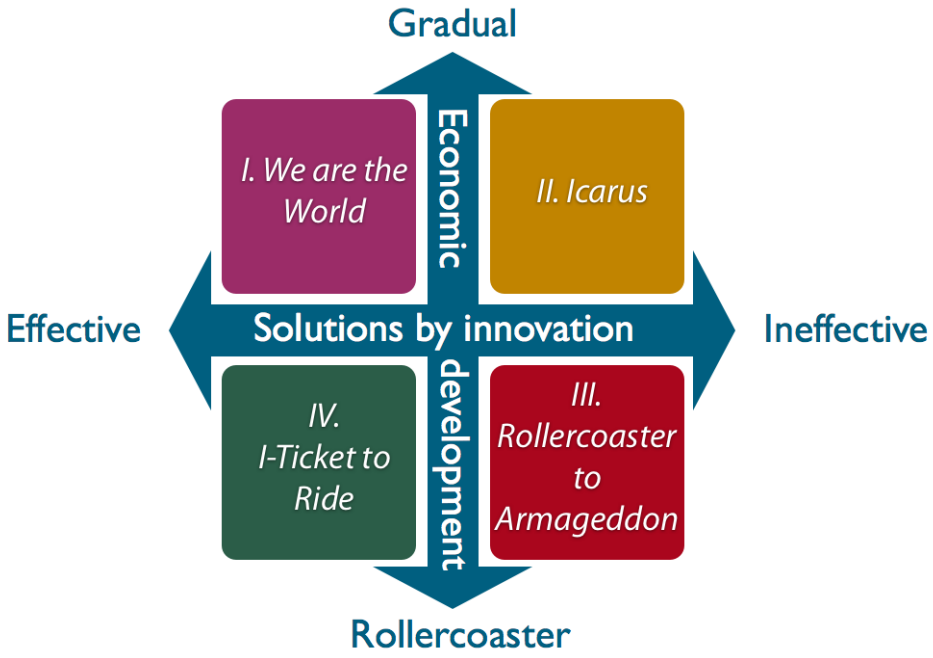


Figure 2: Scenario logic, together with the name of each scenario.

4. The scenarios

4.1. The process

The group of stakeholders was divided into four groups. Each group was composed of four to six people from different sectors of society, age groups and gender, ensuring a multi-disciplinary stakeholder group for each of the scenarios to be developed. Each group was also assigned a professional facilitator and a resource person from the CLIMSAVE research team to answer specific questions or to conduct additional research. The CLIMSAVE research team member did not actively take part in the discussions.

The following guidelines were given to the stakeholders at the start of the scenario development process:

Scenario elements

- Discuss and write down on a white board events which could occur in your scenario;
- Place the events on a timeline. The timeline has two times slices: 2011-2025 and 2025-2050.

Scenario dynamics

- Develop the dynamics of your storyline by linking the different scenario elements to one another so that it becomes a coherent story. Write down the scenario dynamics. If necessary, make use of an influence diagram.

Although the stakeholders had little time to come up with the scenario elements and scenario dynamics, the process in all four groups resulted in rather detailed information on important aspects of their storyline. It is important to point out that at this stage of the process the emphasis lies in developing the scenario dynamics rather than developing a full-fledged storyline.

4.2. We are the world

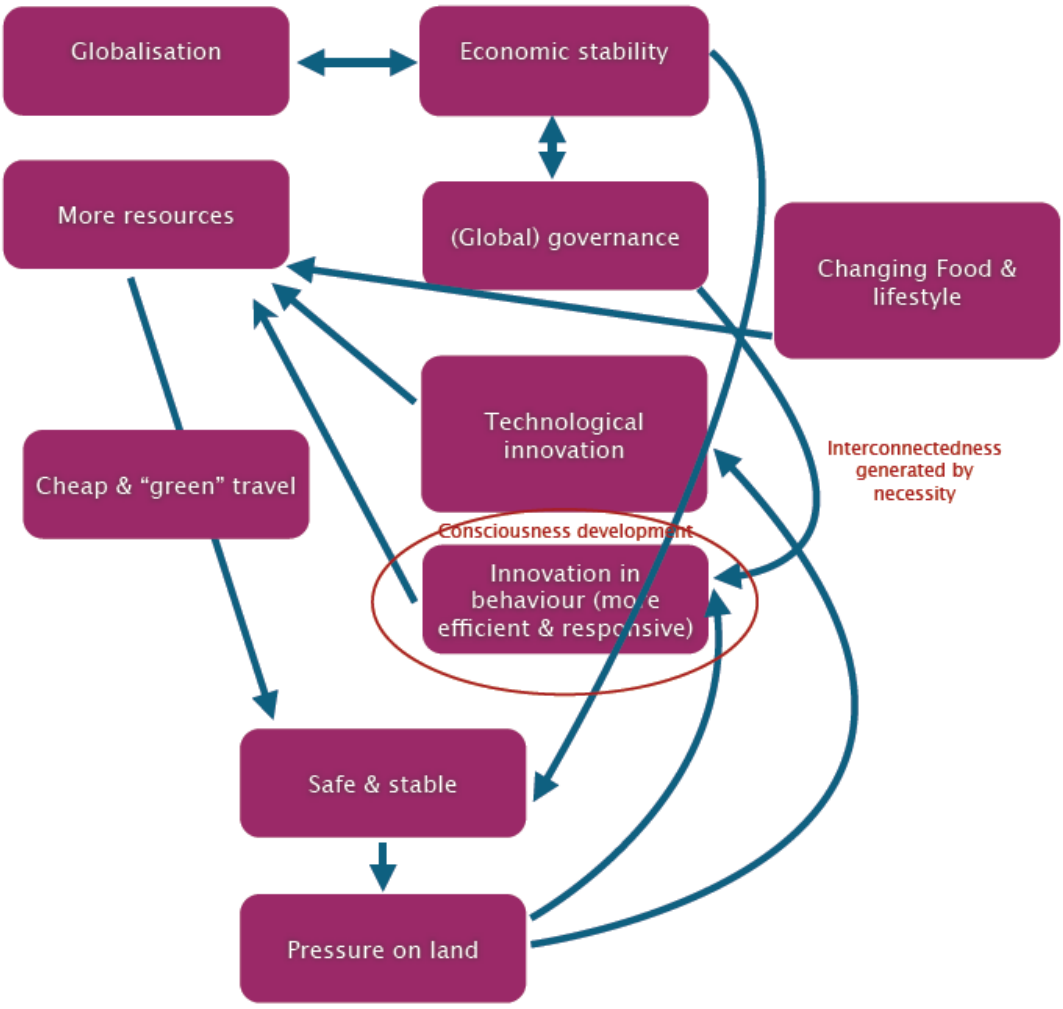
4.2.1. *We are the world scenario elements*[4]

		International price on carbon	International Green Technology Fund with 1000 billions			Change of what VALUE is, Less material, still better quality of life.			
		Ambitious legally binding agreement on climate change		Long term planning for sustainable development	Target oriented advertisement	Worldwide redistribution of production patterns	More equality in the world	More equal society thesis: True!	
Government				Low rate of unemployment worldwide without extra unsustainable spending	Non -egoistic political leaders are here	World language chosen		UN voted for World Constitution	New world government elected
			Coordination based on common sense and real + fair price						
	Efficient judicial systems		Global compensation system on climate change and national hazards						
	From top-down to bottom-up consciousness and return		Natural crises.						
	Mild recession	Interconnection by necessity	Education and skills - Increased awareness and consensus on climate change		Stable moderate growth with regional heterogeneity	Buffering of global economic systems		Air travel is finally green	All-fuel all-terrain vehicles
Technology		Cheap energy source	Saltwater turned into drinking water easily	Efficient water cleaning facilities		Export of solar energy from Africa	Biotech crops sustaining draughts as well as floods (not clear from text)	Geo-engineering first victory on drought	
						Public transport available for 95% of the population	Long term storage of solar energy is possible	100% renewable energy in the world	
			Restaurants serving 90% vegetarian food	Dogs in Europe are converted to vegetarianism	In vitro whale meat				
		Italians eating more pasta to combat climate change	Air conditioning being banned in Europe	Garaging bicycles becomes safe	Safe metro in Paris to discourage people to take taxis.				

2011 2025 2050

[4] The table above is derived from the post-its and flipcharts as drew by the stakeholders during the workshop. An image of the original flipchart / post-its can be found in Annex IV

4.2.2. *We are the world scenario dynamics*[5]



4.2.3. *We are the world scenario storyline*

The scenario logic, elements and dynamics are the building blocks for the development of the scenario storyline. The preliminary, first version, of the scenario has been written by the CLIMSAVE project, but is based on a short presentation of the scenario elements and dynamics (by one of the participants of the scenario development group) during the workshop and additional notes taken by the CLIMSAVE research team during the discussions.

The first scenario storyline below is a preliminary one. Stakeholders will be given the opportunity to refine it during the second stakeholder workshop.

Storyline

Towards the 2020s

In the second decade of the 21st century, Europe is starting to become used to global crises. The financial crisis that started in 2008 continues to have strong repercussions; in Europe,

[5] The scenario dynamics above is derived from the flipchart as it was drew by the stakeholders during the workshop. An image of the original flipchart can be found in Annex IV

national governments face the need to save the Euro-zone, which is under considerable pressure since the first waves of instability in 2010 and 2011. EU leaders are gradually being forced to go further with the Europeanisation of financial policies in order to avoid breakdown and to safeguard economic development. Across the globe, movements advocate for a global response to these, all in all, mild crises in order to ensure stability and sustainability of the planet for the decades to come. These movements do receive a lot of support from people from all layers of society as people gradually become aware that it is important to think global. A realisation of global interdependence takes the upper hand. The feeling that everybody's behaviour has to change to ensure sustainable growth for the next generations is very strong. Italians lead the way by eating pasta instead of meat to combat climate change. Governments all over the world are being put under pressure to take ambitious measures on climate change. Parties with an ambitious programme on climate change and sustainable development do well in elections.

By 2025, the previous decade of crisis seems to have been forgotten. Continuous efforts to transform Europe and the rest of the world into a sustainable environment are now starting to pay their dividends. Globally, there is a stable moderate economic growth and the well being of people increases.

Towards the 2050s

The feeling of being globally interdependent and working together for the same cause, appeals to many people. Intercontinental travel increases and people are eager to learn more about other cultures. In 2035 an intergovernmental body is set-up to select one world language. People also sympathise more with those in society that do not have the same standard of living. Gradually people learn to revaluate again the importance of meeting friends in real life instead of chatting to them via social networks. Social capital increases over time and the value of things is measured by the quality of life it gives you, not by their mere numerical value. This also leads unintentionally to a much safer world. Crime rates go down. As a result, people feel safe to use public transportation systems and to commute to work by bike without having to worry about it being stolen. In return, this contributes to less CO_2 emissions.

By 2035, technological developments have made it possible to export solar energy from Africa. Moreover, genetically modified crops can now overcome droughts as well as floods. By 2040, air travel is finally officially declared a CO_2-neutral activity. Now people can finally travel to other parts of the world without having to feel guilty. At the 93rd session of the UN General Assembly in 2041 a world constitution is adopted. The constitution is based on values such as equality and equal redistribution of resources for all, and has safeguards in it for sustainable growth. The World Constitution also has a set of articles on how to elect a world government. By 2050, barely 10 years after the adoption of a world constitution, the first world government is elected. This government is elected on the basis of a programme of social equity and sustainable economic development. In general, the people living in this world in 2050 are happy. Technological advancements have made it possible for large parts of the global population to lead a safe and stable life. Solidarity plays an important aspect in the life of people. The people are also aware of the fact that the ability to live a safe and stable life is an achievement and do everything to keep it this way.

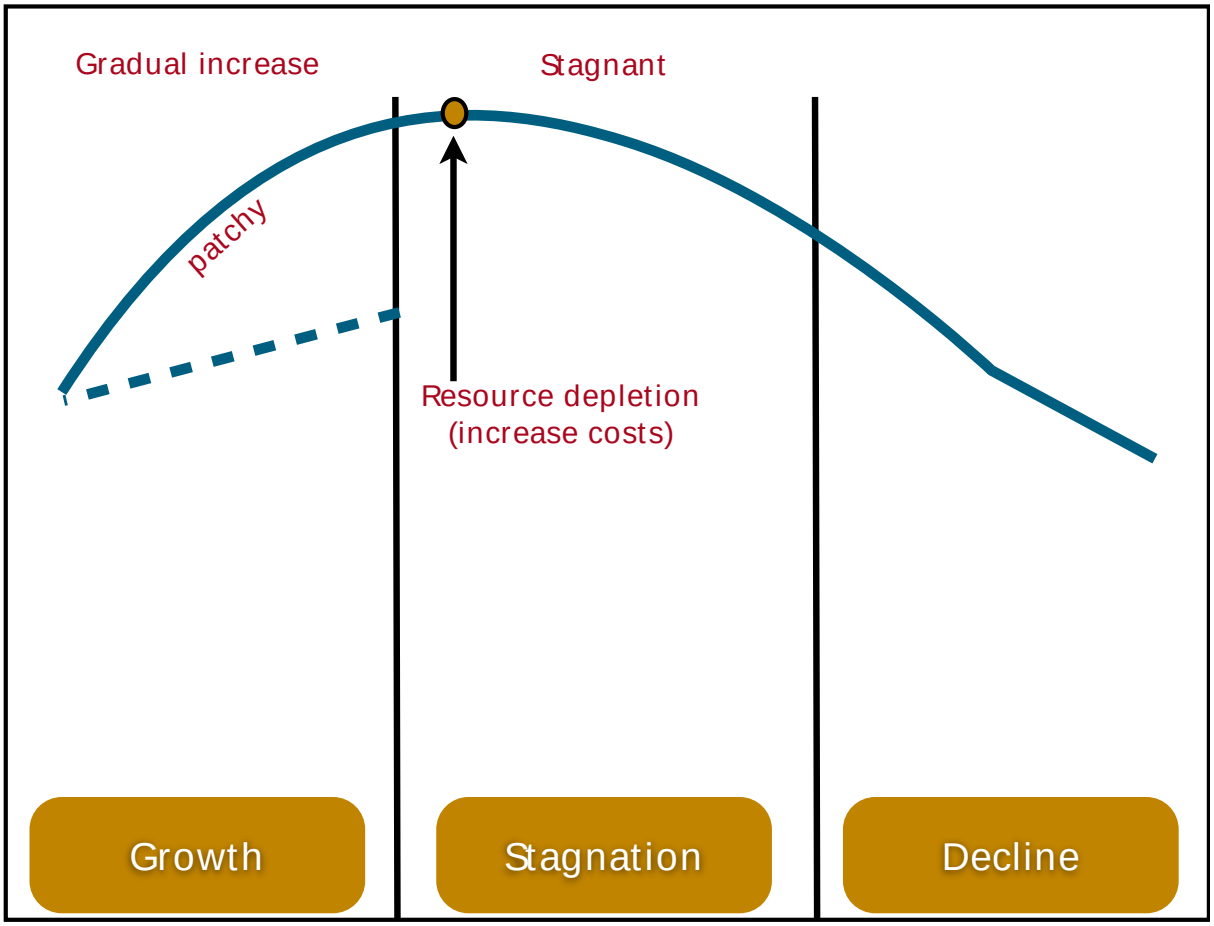
4.3. Icarus

4.3.1. *Icarus scenario elements*[6]

		Coalition governments	Political fragmentation		Nationalism: focus on national interests, collapse of international collaboration	Unstable international coalitions prevent implementing solutions		Water wars
Political		Policy shortism		Schism in the EU Lobbying		Media attention Populism		War between China and West in Africa
		(No perception of urgency, muddling through business as usual)						
Economic		**Stable growth**		Service economy	**Stagnation**			**Decline**
	High energy consumption		Increased costs of resources		Increased unemployment	Inflation		Food shortages
				Decline of welfare state				
Social			Widening gap between haves and have nots		Social unrest	Increased mobility. People moving, changing jobs	Rise of post-modern values	
					Social mobilisation	Climate change refugees		Lifestyle changes Paralysis
Environment				Depletion of oil	No scientific breakthrough	Ecosystem failure & services		
	Decrease of natural resources		Too little too late		High impact of natural disasters		Sense of urgency	
		Mudding through, no perception of urgency, business as usual			Biodiversity loss		Greater vulnerability	

[6] The table above is derived from the post-its and flipcharts as drew by the stakeholders during the workshop. An image of the original flipchart / post-its can be found in Annex IV

4.3.2. *Icarus scenario dynamics*[7]



High energy consumption Decrease of natural resources	Focus on national interest Shortism Populism Gap between haves and have nots Social unrest and population decline	Multipolarism social unrest Intercontinental conflicts Social mobility
I	II	III
Population growth	Lobbyism Social mobilisation	Live with less

[7] The scenario dynamics above are derived from the flipchart as it was drew by the stakeholders during the workshop. An image of the original flipchart can be found in annex IV.

4.3.3. *Icarus scenario storyline*

The scenario logic, elements and dynamics are the building blocks for the development of the scenario storyline. The preliminary, first version, of the scenario has been written by the CLIMSAVE project, but is based on a short presentation of the scenario elements and dynamics (by one of the participants of the scenario development group) during the workshop and additional notes taken by the CLIMSAVE research team during the discussions.

The first scenario storyline below is a preliminary one. Stakeholders will be given the opportunity to refine it during the second stakeholder workshop.

Storyline

Towards the 2020s

After the difficult year 2011, in which the European Economy leaned towards a recession, the European economy picks up again as of 2012, with a gradual economic growth for the years to come. With the economy gradually picking up, the demand for resources equally increases. As a result the price for raw materials such as oil and steel goes up on the world market. Initially, it is possible for both developed as well as developing countries to benefit from this gradual economic growth. Towards the 2020s it becomes first increasingly difficult for enterprises in developing countries to sustain their activities in the face of increasing prices for raw materials. Later on also industrialised economies start to struggle, as enterprises can no longer afford the exuberant prices for oil. As of 2022, the economy in Europe is stagnating.

The stagnation of the economy equally means the revenues of governments are going down. In light of increasingly scarce public resources, long-term policy planning makes way for short-sighted policy measures driven by electoral gains. Because politicians feel they can win elections on specific short-term issues, the political landscape fragments. In several European countries incumbent political parties disintegrate weeks before the elections. Political fragmentation forces political parties to form coalition governments, which weakens the position of the government. Policy shortism equally means that politicians focus on internal, domestic issues. Heads of states and governments no longer attend EU summits by 2025. This illustrates that governments find it more appropriate to combat cross-border problems such as an overall economic stagnation by domestic solutions. After having been on the rise in the beginning of the millennium, nationalism weakened for a decade, but as of 2022 it is firmly on the rise again. It is each country for itself. In 2011, a schism over heavily indebted countries in the EU was narrowly avoided through the will of politicians to keep the Euro zone together. This will is now totally absent and by 2028 a schism in the EU becomes reality.

Towards the 2050s

The stagnation of the economy also has repercussions on the European population. Unemployment rates go up and because public finances are going down, social benefits also shrink. This results in a widening gap between the haves and the have not's in Europe. The richer people in society can afford to pay for the services and goods they need, while the poor cannot. People in countries with a weak economy are especially hit hard by the economic stagnation. People move to other countries to find jobs. However, with nationalism on the

rise, labour migrants are not well received in the reception country. People are afraid migrants will steal their jobs and take away their social benefits. The social fabric disintegrates further.

The flow of migrants is also strongly affected by the effects of climate change. The economic growth of the last decade, together with a strong demand for natural resources has been a tipping point for the state of the environment of the European Union. Severe ecosystem failures are starting to occur as of 2015 and by 2025 extreme weather events cause a high burden on Europe, its citizens and its economy. There is a further loss of biodiversity by 2030. In addition to migration because of economic reasons, people in those parts of Europe that are heavily affected by floods and droughts also move to safer areas. Labour migration, as well as climate change migration, leads to expat ghettos in Berlin. The impact of extreme weather events, together with a stagnation of the economy brings about shortages of some essential goods and services; notably food and water shortages. At this point in time, the economy goes from stagnation into decline. The economic downturn leads to agitation and frustration between different countries. By 2040 tensions over water at the border of Europe lead to conflict.

By 2045, the sense of urgency leads a counter movement to voice its concerns over the current state-of-affairs in Europe. The main claim of the movement is that people in Europe have to start living in a different manner. Post-modern values become more important. By 2050, post-modern values have become more important, but remain nevertheless subordinate to hard economic values and the will of some to gain prosperity at the expense of others. Food shortages remain common, especially in those countries that have been affected by the water wars, and the war in Africa between China and the West.

4.4. Rollercoaster to Armageddon

4.4.1. *Rollercoaster to Armageddon scenario elements*[8]

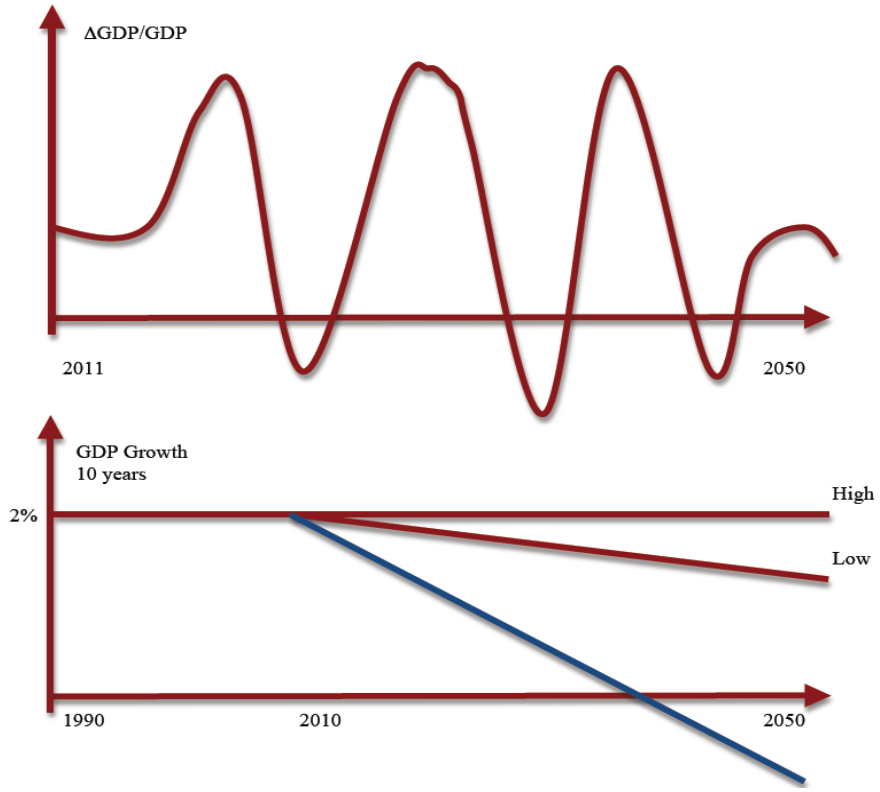
			Natural hazards	Droughts -fires heavy rains, floods and landslides						
				Technology failure	Decrease in standard of living					
				Damaged ecosystems Low yielding crops	Increasing costs					
		Priority: decisions and investments				Social systems fail - Inequalities	Conflicts and instability	Extremists (good and bad) stronger. Multiple breakdowns		
				Limitations and regulations	Rethink global climate policy: World Climate Organisation					
						Development of informal support network	Social cohesion strengthens			
			Increase of the costs of raw materials and energy	Technical fix to clean up groundwater not working		Low investments in social systems	Water conflicts	Constant armed conflicts	Global economic crises every 3 years	Governmental regulation of food distribution
			Agriculture costs increase: hunger	Insurance failure		Increased inequality both within EU and between countries	Social conflict	Cycle of migration from poor to rich	Breakdown in ability to react to crisis	Limits to natural resources is introduced
			Substitution of key economic resources not quick enough	High transport costs		More indebted countries	Geopolitical instability due to competition for resources	Political instability and government fail	Failing states sell ecosystem assets	Limits in land use is required
			Technology fails: strong focus on ecological solutions	Historical heritage damaged			More polarised society	Number of failing states	China, India and the US introduce resource export bans	Need to prioritise resources as limited Sacrificing sectors

2011 2025 2050

[8] The table above is derived from the post-its and flipcharts as drew by the stakeholders during the workshop. An image of the original flipchart / post-its can be found in Annex IV

4.4.2. *Rollercoaster to Armageddon scenario dynamics*

No specific scenario dynamics was provided for the Rollercoaster to Armageddon scenario by the stakeholders, but a number of graphs were drawn by the stakeholders.



4.4.3. *Rollercoaster to Armageddon scenario storyline*

The scenario logic, elements and dynamics are the building blocks for the development of the scenario storyline. The preliminary, first version, of the scenario has been written by the CLIMSAVE project, but is based on a short presentation of the scenario elements by one of the participants of the scenario development group during the workshop and additional notes taken by the CLIMSAVE research team during the discussions.

The first scenario storyline below is a preliminary one. Stakeholders will be given the opportunity to refine it during the second stakeholder workshop.

Storyline

Towards the 2020s

After the annus horribilis of 2008 and 2011, the European economy is in a bad shape 12 years into the new millennium. For the period of 2012-2015, the European economy temporarily revives thanks to innovations coming from the pharmaceutical industry. In an attempt to revamp the European economy even further European policy-makers decide to invest in innovations with a big return on investment in the short run. The military and nuclear industries receive subsidies to modernise themselves.

Meanwhile, the depletion of natural resources continues at an ever-quicker rate, but politicians and decision-makers at all levels turn a blind eye to these developments. The first

priority for them is to get the economy back on track. Natural hazards, droughts, forest fires, and heavy rains all occur, but policy-makers decide to put the limited public resources into measures for stimulating the economy and not into innovative solutions to combat natural resources depletion. These measures spark economic growth, but resource depletion continues.

The effects of a depletion of natural resources become increasingly visible. Crop failures occur and also the standard of living in those areas affected by droughts, floods and landslides decreases significantly. Food prices go up and also the price of other essential commodities such as energy goes up. By 2020, some budget is available to do research on cleaning up groundwater, but the attempt to fix it fails. Also other attempts to find innovative ecological solutions to combat the depletion of natural resources are unsuccessful.

The decreasing standard of living does not happen for all citizens in the same way. In countries / areas that are not severely affected by droughts and floods people can still maintain their standard of living, but in areas that are severely affected people pay a heavy price. By 2025, there is a widening gap in society between those that are affected by the depletion of natural resources and those that are not.

Towards the 2050s

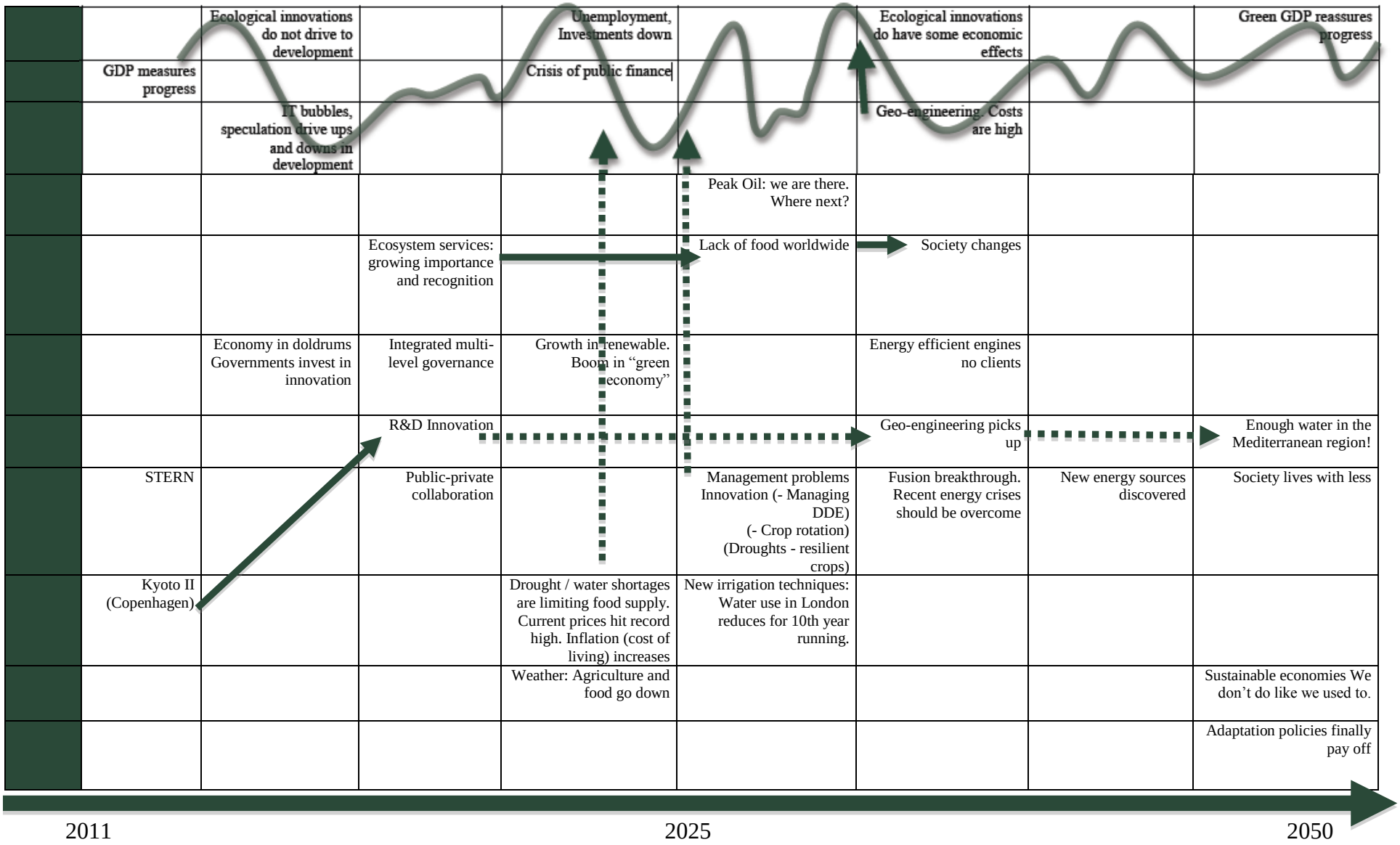
Those not affected become frontrunners in trying to lift Europe out of an economic dip. But without sustainable, innovative solutions, revamping the economy is each and every time based on making use of those resources that are severely depleted. This does not create a stable situation and eventually leads to a mini economic crisis every three to four years as of 2028.

The divide between the "affected" and "not affected" not only leads to an increasing inequality, both within the EU as well as within countries, but also to conflicts. Conflicts over scarce resources take place at many different levels and have many different faces. Internally, inequality leads to political instability and government failures. Some states outside of Europe fail because they don't succeed in distributing resources equally. The rulers of failed states try to sell ecosystems assets, while the governments of China, India and the United States decide to introduce a resource export ban. By 2040, inequality and resource redistribution leads to geopolitical instability and tensions all over the world. Some people deprived from a number of essential resources migrate to resource abundant regions. Eventually this leads to armed conflicts by 2045.

In an attempt to bring the rollercoaster of short exponential economic growth and deep economic crises to a halt, governments in Europe start to regulate the use of resources very strictly in 2050. A case in point is the regulation of food distribution and limited land use. This proves to be a good recipe to avoid further chaos as tensions over resources ease off. Countries regulate more strictly the use of land, which takes away the pressure for internal and external conflict over resources. This has an immediate effect on the growth of GDP. The growth of GDP is not as strong as in previous years, but growth is now smaller, but more stable and sustainable because of the regulated use of resources. Inequalities do remain, especially in between different countries, but intra-country the inequalities decrease. The cost of living stabilises while the standards of living converge within a country. Natural hazards continue to occur, but their intensity and frequency has not changed much compared to the 2020s, so they remain a challenge in the 2050s.

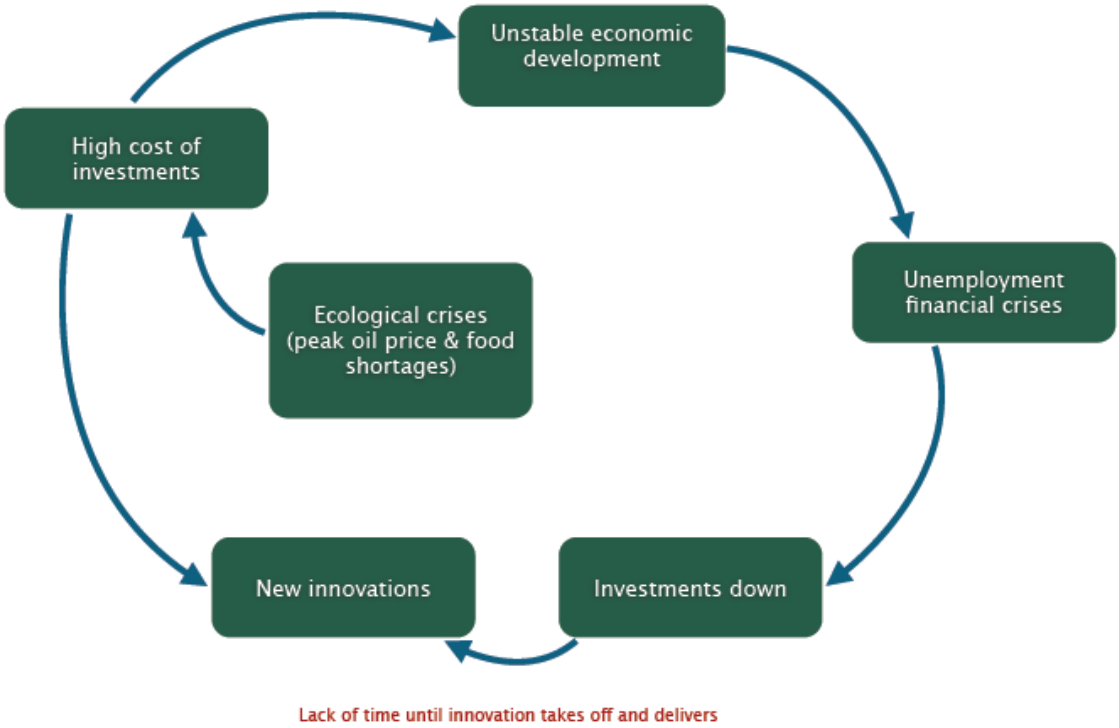
4.5. I-Ticket to ride

4.5.1. *I-Ticket to ride scenario elements*[9]



[9] The table above is derived from the post-its and flipcharts as drew by the stakeholders during the workshop. An image of the original flipchart / post-its can be found in annex IV

4.4.2. *I-ticket to ride scenario dynamic*[10]



4.4.3. *I-ticket to ride scenario storyline*

The scenario logic, elements and dynamics are the building blocks for the development of the scenario storyline. The preliminary, first version, of the scenario has been written by the CLIMSAVE project, but is based on a short presentation of the scenario elements and dynamics (by one of the participants of the scenario development group) during the workshop and additional notes taken by the CLIMSAVE research team during the discussions.

The first scenario storyline below is a preliminary one. Stakeholders will be given the opportunity to refine it during the second stakeholder workshop.

Storyline

Towards the 2020s

Since the crisis of 2008, the European economy has been fluctuating strongly. This trend, which was originally thought to last only a few years, is becoming the general pattern of development for Europe for the next decades.

In 2012, world leaders fail to reach an agreement on the successor of the Kyoto protocol. However, extreme weather events in Europe demonstrate that adaptation measures are needed more than ever. Droughts in southern Europe lead to large-scale failures of harvests in large parts of Greece, Italy and Spain. Because those countries supply a lot of fruit and vegetables

[10] The scenario dynamics above is derived from the flipchart as it was drawn by the stakeholders during the workshop. An image of the original flipchart can be found in Annex IV.

to the rest of Europe, the scarcity of fruit and vegetables leads to food shortages and inflation. Alternatives to fruit and vegetables from southern Europe become very expensive. This is acerbated by the production cost of fruit and vegetables in greenhouses in western and eastern Europe going up because of high oil prices. Hence, the droughts in southern Europe have a knock-on effect for the rest of Europe and its economy. Governments from southern Europe have to bail out those sectors that have run into trouble. They make use of the permanent European Emergency Fund, which was set up in 2011 after the Euro crisis. For the first time, newspapers speak of climate change unemployment.

Despite no global agreement, the EU continues to put a lot of efforts and resources into climate change adaptation measures. In its adaptation strategy, the EU is wholeheartedly committed to finding innovative solutions to the depletion of natural resources. Key to this strategy is public-private collaboration. Despite difficult economic times, the EU and national governments do not cut funding schemes for private initiatives. "Private initiatives for public solutions" becomes a very successful funding scheme. But this is only the tip of the iceberg. The funding scheme sets in motion a whole era dominated by the will to find innovative solutions to the depletion of natural resources. One of the first milestones of this era is the exponential growth of renewables. By 2025 the green economy is finally booming. Managing the effects of extreme weather events becomes a new challenge for the European continent in this era.

Towards the 2050s

By 2030 Europe has successfully implemented new irrigation techniques to combat droughts. New irrigation techniques also make it possible to reduce the use of water. In 2035, water use in London is reduced for the 10^{th} year running. In light of ever more disastrous effects of climate change, the resistance against geo-engineering eases off. Albeit still being very costly, geo-engineering picks up by 2040. A new milestone comes in 2042 when fusion power makes it possible to overcome the energy crises.

By 2045-2050, a change in attitude is noticeable in Europe. Europeans have learned to master some of the negative effects of climate change, but this does not make them reckless. Together with learning to master the effects of climate change, Europeans have also learned to have more respect for natural resources. Adaptation policies pay off, not only because there are technological solutions at hand, but also because the population is very supportive and makes it possible for them to pay off. Hence there is a high increase in social capital. This trend continues in the 2050s and is reflected in a steady green GDP growth and an increase in purchasing power. The fact that Europe is a good place to live by 2050 is also reflected in a population increase compared to the 2020s.

5. Quantification of selected key variables and capitals using the fuzzy-set approach

5.1. The quantification exercise explained[11]

At the workshop stakeholders were asked to take part in both group and individual exercises on quantifying key drivers for input to the set of meta-models within the Integrated Assessment Platform of CLIMSAVE. As only a limited amount of time was available within the workshop, the maximum number of model parameters that could be quantified by stakeholders was estimated to be seven. These seven model variables were selected to provide guidance on the quantification of a much wider range of socio-economic variables used within the meta-models. In addition to these seven model variables, a further five variables relating to capitals (natural, human, social, manufactured and financial) used in the adaptive capacity and vulnerability parts of CLIMSAVE were quantified. The interest in capitals[12] is threefold:

- as a performance measure of the overall wealth of society, showing the ability to sustain standards of human welfare;
- as an indicator of the vulnerability of a system. The higher the exposure to a pressure and the lower the capital stocks the higher is the vulnerability of this system to the pressure; and
- as an indicator of the ability of a society (or region, or sector) to adapt to changing circumstances (such as the increasing exposure to weather extremes). The indicator can be altered by the adaptation options taken.

The following variables were considered:

1. GDP
2. Population
3. Protected areas for nature
4. Food import ratio
5. Arable land used for biofuels
6. Oil price
7. Household size
8. Natural capital
9. Human capital
10. Social capital
11. Manufactured capital
12. Financial capital

Two time scales were distinguished from the present to the 2020s and from the 2020s to the 2050s. Stakeholders were asked to quantify the variables for these two time scales for the EU as a whole. Further, four EU regions were distinguished (north, east, south and west) to obtain some regional differentiation in the trends and values of the socio-economic variables across Europe. Distinguishing more than four regions would not have been feasible within the time

[11] Please note that in the workshop only Steps one and two of the quantification exercise were undertaken. Step three in which the results are analysed is reported in Dubrovsky et al. (2011). Report on the European driving force database for use in the Integrated Assessment Platform. Available from www.climave.eu.

[12] For further information on the use and definitions of capitals in CLIMSAVE see Omann et al. (2010). Report on the development of the conceptual framework for the vulnerability assessment. Available from www.climsave.eu.

available within the workshop. The fuzzy sets approach used in the quantification process and its three steps are reported in detail in Dubrovsky et al. (2011)[11] along with the analysis of the aggregated data from the individual exercise.

Step One: Group exercise

Stakeholders were asked to indicate in linguistic form the scenario trends for the 12 key variables. For example, the population in southern Europe in the period 2010-2025 will be "high". Participants were asked to discuss this with the other participants of their scenario developing group and to come up with a group answer. To this end, each group was provided with one page for each of the variables in which they could fill in their best estimates about how that variable might develop under the specific storyline assumptions. To assist the stakeholders with this exercise a number of reference figures or tables were provided. Each group was also supported by a CLIMSAVE expert and a facilitator.

Expressing these trends in linguistic form is consistent with the linguistic form of the storylines developed by the stakeholders. Key variables described in word form can be more easily and naturally included in the storylines. Furthermore, it is much more practical for a group of stakeholders to agree on a qualitative description of a key variable ("medium increase") than on a numerical value ("2% per year"). Moreover, it is also likely that the stakeholders are more competent to specify qualitative values of different key variables than exact numerical values.

Step Two: Individual exercise

In order to translate these (qualitative) linguistic variables into (quantitative) information the stakeholders were asked in a second step to individually complete a work sheet in which they provided information on what they meant by, for example, a "medium" value. For the individual exercise stakeholders were not allowed to discuss their choices with others.

Step Three: Defining the translation key and computing the numerical values

The answers from the individual work sheets were analysed by the CLIMSAVE research team to define a "translation key"[11] that can be used to convert the trends of the key variables in word form to numerical form. This is then applied to the scenarios to produce the quantitative values needed to run the different meta-models of the Integrated Assessment Platform.

5.2. Step One: Results of the group exercise

The stakeholders were asked to answer the following questions:

1. What is the GDP growth in the 2020s/2050s in percent per annum?
2. What is the annual growth rate in population in the 2020s/2050s?
3. What is the ratio of land protected for nature in the 2020s/ 2050s?
4. What is the percent of food that is imported in the 2020s/2050s?
5. What is the percentage of arable land used for biofuel production in the 2020s/2050s?
6. What is the oil price per barrel in the 2020s/2050s?
7. What is the household size in the 2020s/2050s?
8. What will be the changes in natural capital in the 2020s/2050s?
9. What will be the change in human capital in the 2020s/2050s?
10. What will be the change in social capital in the 2020s/2050s?
11. What will be the change in manufactured capital in the 2020s/2050s?
12. What will be the change in financial capital in the 2020s/2050s?

For the questions on GDP, population, protected areas for nature, food import ratio, arable land used for biofuel production, oil price and household size the stakeholders could choose one of the following answers:

vl = very low
l = low
m = medium
h = high
vh = very high

For the questions on the capitals the stakeholders could choose one of the following answers:

h+ = high increase
m+ = moderate increase
0 = no changes
m- = moderate decrease
h- = high decrease

5.2.1. *We are the world scenario*

Table 3a: Specification of trends of key variables in linguistic terms for the "We are the world" scenario.

	GDP	**Population**	**Protected areas**	**Food imports**	**Arable land for biofuels**	**Oil price**	**Household size**
2020s:							
EU	l	l	m	l	l	vh	l
North	l	l	m	l	l	vh	l
East	m	l	m	l	l	vh	l
South	l	l	m	l	l	vh	l
West	l	l	m	l	l	vh	l
2050s:							
North	l	l	m	l	vl	h	l
East	l	l	m	l	vl	h	l
South	l	l	m	l	vl	h	l
West	l	l	m	l	vl	h	l
EU	l	l	m	l	vl	h	l

Table 3b: Specification of trends of Capitals in linguistic terms for the "We are the world" scenario.

	Natural	Human	Social	Manufactured	Financial
2020s:					
EU	0	m+	m+	m+	m+
North	0	m+	m+	m+	m+
East	0	m+	m+	m+	m+
South	0	m+	m+	m+	m+
West	0	m+	m+	m+	m+
2050s:					
EU	m+	h+	m+	m+	0
North	m+	h+	m+	m+	0
East	m+	h+	m+	m+	0
South	m+	h+	m+	m+	0
West	m+	h+	m+	m+	0

5.2.2. *Icarus scenario*

Table 4a: Specification of trends of key variables in linguistic terms for the "Icarus" scenario.

	GDP	Population	Protected areas	Food imports	Arable land for biofuels	Oil price	Household size
2020s:							
EU	l	l	l	m	m	h	m
North	l	l	m	m	m	h	m
East	l	l	l	m	m	h	m
South	vl	l	l	m	m	h	m
West	l	l	m	m	m	h	m
2050s:							
EU	vl	l	vl	l	m	vh	h
North	vl	m	m	l	m	vh	h
East	vl	vl	vl	l	m	vh	h
South	vl	vl	vl	l	m	vh	h
West	vl	m	m	l	m	vh	h

Table 4b: Specification of trends of Capitals in linguistic terms for the "Icarus" scenario.

	Natural	Human	Social	Manufactured	Financial
2020s:					
EU	m-	0	0	0	0
North	m-	0	0	0	m+
East	m-	0	0	0	m-
South	m-	0	0	0	m-
West	m-	0	0	0	0
2050s:					
EU	h-	m-	m-	0	m-
North	h-	m-	m-	0	m+
East	h-	m-	m-	0	m-
South	h-	m-	m-	0	m-
West	h-	m-	m-	0	0

5.2.3. *Rollercoaster to Armageddon scenario*

Table 5a: Specification of trends of key variables in linguistic terms for the "Rollercoaster to Armageddon" scenario.

	GDP	Population	Protected areas	Food imports	Arable land for biofuels	Oil price	Household size
2020s:							
EU	m	l	m	m	m	h	m
North	h	vl	m	m	h	h	m
East	h	l	m	m	l	h	m
South	l	m	h	m	l	h	m
West	m	vl	m	m	m	h	m
2050s:							
EU	l	vl	l	l	vl	vh	h
North	m	vl	l	l	m	vh	h
East	l	l	l	l	vl	vh	h
South	vl	l	m	l	vl	vh	h
West	l	vl	l	l	l	vh	h

Table 5b: Specification of trends of Capitals in linguistic terms for the "Rollercoaster to Armaggedon" scenario.

	Natural	Human	Social[13]	Manufactured	Financial[14]
2020s:					
EU	m+	m+	0	m+	0
North	h+	h+	0	m+	m+
East	m+	0	0	m+	m+
South	m+	0	0	m+	m-
West	m+	m+	0	m+	0
2050s:					
EU	m-	m-	0	m+	m-
North	m+	0	0	m+	0
East	m-	m-	0	m+	m-
South	h-	m-	0	m+	h-
West	0	0	0	m+	m-

5.2.3. *I-ticket to ride scenario*

Table 6a: Specification of trends of key variables in linguistic terms for for the "I-ticket to ride" scenario.

	GDP	Population	Protected areas	Food imports	Arable land for biofuels	Oil price	Household size
2020s:							
EU	l	vl	h	h	h	vh	m
North	m	vl	h	m	h	vh	m
East	vl	vl	h	h	h	vh	m
South	vl	vl	h	m	h	vh	m
West	l	vl	h	h	h	vh	m
2050s:							
EU	m	l	m	l	l	vl	m
North	h	m	m	l	l	vl	m
East	l	l	m	l	l	vl	m
South	l	l	m	l	l	vl	m
West	m	l	m	l	l	vl	m

[13] Comment by stakeholders on social capital: Increase in informal social organisations + improved social cohesion in family groups, voluntary organisations, etc. Decrease in formal - none political parties. Polarised society - high social capital within groups, low in between.
[14] Comment of stakeholder on financial capital: same logic as GDP.

Table 6b: Specification of trends of Capitals in linguistic terms for the "I-ticket to ride" scenario.

	Natural	Human	Social	Manufactured	Financial
2020s:					
EU	m-	m+	m+	0	m-
North	m+	m+	m+	0	m-
East	m-	m+	m+	0	m-
South	h-	m+	m+	0	m-
West	m-	m+	m+	0	m-
2050s:					
EU	m+	m+	h+	0	m+
North	m+	m+	h+	0	m+
East	m+	m+	h+	0	m+
South	m+	m+	h+	0	m+
West	m+	m+	h+	0	m+

5.3. Steps Two & Three: Results of the individual exercise, defining the translation key and computing numerical trends of key variables

Steps two and three are reported in Dubrovsky et al. (2011)[11] where the aggregate results from the individual work sheets are provided as well as the methodology and results for creating the translation key and applying it to the qualitative values to compute the quantitative values required by the meta-models in the Integrated Assessment Platform.

6. Concluding remarks

6.1. Remarks on the storyline development process

At the end of the workshop stakeholders were asked to give their views on the scenario development process so far. This resulted in the following comments:

Overall a feeling of satisfaction:
"Very good - promising! Very interesting process. Looking forward to how this develops.", "Very interesting process, good storylines.", "Process worked well according to the high diversity of participants. These scenarios should be looked at in reference to external scenarios."

Stakeholders however expressed their doubts on the use of the driving forces and uncertainties:
"The uncertainties underlying the scenarios are too correlated. Other uncertainties would need to be somehow factored in e.g. geopolitical stabilities, belief systems", "The economic parameter is unclear: sustainable/unsustainable?", "I wonder if we picked the "right" two uncertainties? There are probably other combinations that are equally interesting?", "Well structured, some confusion initially on the list of uncertainties".

To some stakeholders it was still unclear what the outcome of the project will be and what the relation of the scenarios is to the models:
"Unfortunately I am still unclear where the whole work will lead exactly: what will be the use of the scenarios developed? But it was an interesting experience for me, as I haven't been involved in scenario building before.", "I think it would have been useful to have a closer and more specific relationship with the models' needs, regarding quantitative input."

Random remarks:
"I am not convinced that developing new scenarios is needed or essential to this project.", "I have some methodological doubts about all this, triangulating your data and your analytical tools is trying if you don't want to be attacked by scientists on methodological grounds."

6.2. Remarks on the quantification of the key variables

At the end of the workshop stakeholders were asked to give their views on the quantification of key variables. This resulted in the following comments:

Overall stakeholders were satisfied with the group quantification exercise, but they had more doubts on the individual exercise:
"Quite positive. Other variables could have been taken into consideration", "Quite good. Concrete and quite easy. Interesting.","Worked well in the group, personally I had problems with the individual exercise and it seems others had the same issue. Therefore the estimates might be not very useful.", "In an ideal world with unlimited day length it would have been good to have the quantification session directly after the story development, since the reasoning is fresher. I don't remember all the arguments from the group discussion for my personal quantification."

Many stakeholders also found it difficult to give adequate answers:
"Difficult process in accurately reflecting elements of the storylines into constraints of the models.", "Variables not well defined and insufficient information for my answers to be useful."

Random remarks:
"Very questionable, particularly if you do not believe in CCA.", "Unclear where it leads to."

6.3. Conclusions

The stakeholders were satisfied with the overall process of the workshop. Most stakeholders indicated their satisfaction with the process and their willingness to return for the second and third workshops. The most frequent criticisms were on the one hand related to the uncertainties and driving forces and on the other hand related to the quantification session, which many found difficult, as they believed they didn't always have the knowledge to answer the questions adequately.

There was widespread satisfaction with the results that were produced. A list of driving forces and main uncertainties was agreed upon and four preliminary scenarios have been developed. The results provide an excellent basis as input for the different meta-models used in the CLIMSAVE Integrated Assessment Platform.

Content-wise, the scenarios can and will be improved, but the stakeholders provided many concrete points of criticism to base the improvements on.

7. Next steps

The second out of a series of three workshops will be held on 6-8 February 2012 in Prague, Czech Republic. During this workshop the preliminary storylines will be refined and finalised. At the workshop stakeholders will also have the opportunity to have their first interaction with the Integrated Assessment Platform (IAP). To this end, the CLIMSAVE research team will insert the values of the fuzzy set exercise into their meta-models within the IAP with which the stakeholders will interact.

Annex I: Agenda

Tuesday 10 May 2011

12.30-onwards Registration

WELCOME & GENERAL INTRODUCTION

14.00 Welcome – Dr Marc Gramberger (Prospex)

Introduction to the CLIMSAVE project – Dr. Paula Harrison (University of Oxford)

CLIMSAVE input to policy processes – Dr. Wolfram Schrimpf (DG Research, European Commission)

Overview of workshop – Dr. Marc Gramberger (Prospex)

15.30 Coffee / Tea

MEGA-TRENDS, CERTAINTY AND UNCERTAINTY

16.00 Megatrends, certainties and uncertainties - Prof. Dr. Kasper Kok (University of Wageningen) & Dr. Marc Gramberger (Prospex)

Expanding, refining and working out uncertainties - participants

18.00 End of day's work

19.00 Surprise

20.00 Dinner – restaurant Maximiliaan van Oostenrijk

Wednesday 11 May 2011

09.00 Overview of the day – Dr. Marc Gramberger (Prospex)

SCENARIO LOGIC

09.10 Defining scenario logics – participants

10.30 Coffee / Tea

SCENARIO ELEMENTS & DYNAMICS

11.00 Identifying scenario elements and dynamics – participants

12.30 Lunch break in restaurant of hotel Navarra

DEVELOPING SCENARIO STORYLINES

14.00 Creating scenario timelines – participants

15.30 Coffee / Tea

16.00 Presentation of results

Incorporating feedback

18.00 End of day's work

19.00 Dinner – restaurant De Halve Maan

Thursday 12 May

09.00 Overview of the day – Dr. Marc Gramberger (Prospex)

QUANTIFIABLE STATEMENTS

09.10 Making quantifiable statements – participants

11.00 Coffee / Tea

11.30 Defining categories – participants

12.30 A preview of the IAP: Integrated Assessment Platform – Dr. Ian Holman (University of Cranfield)

13.00 Lunch break in restaurant of hotel Navarra

NEXT STEPS AND CLOSURE

14.00 Next steps - Prof. Dr. Kasper Kok (University of Wageningen)

Final reactions and evaluation

Closure – Dr. Marc Gramberger (Prospex)

15.00 End of workshop

Annex II: List of Participants

Participants:

Benzaken	Dominique	International Union for Conservation of Nature (IUCN)	EU Outermost Regions and Overseas Countries and Territories Programme Coordinator
Borak	Dalibor	Czech Chamber of Architects	Architect
Börzel	Tanja	Humboldt University	Professor
Cachia	Stefan	Ministry for Resources and Rural Affairs	EU Affairs Director
Chloupkova	Jarka	Independent	Independent
Ciscar	Juan Carlos	European Commission - JRC	Action Leader
Delsalle	Jacques	European Commission - DG Environment	Policy Officer
Hagg	Joseph	Scottish Climate Change Impacts Partnership (SCCIP)	Science Officer
Isoard	Stéphane	European Environment Agency (EEA)	Project manager - Climate change adaptation and economics
Kockler	Vera	Ecumenical Youth Council in Europe (EYCE)	Staff Member
Kolström	Marja	European Forest Institute (EFI)	Senior Researcher
Kristoffersen	Gunn	Confederation of Vocational Unions (YS)	Adviser
Marino	Trimboli	European Federation of Geologists	Board EU Delegate
Olie	Rene	Rotterdam School of Management, Erasmus University	Associate Professor
Schrimpf	Wolfram	European Commission - DG Research	Deputy Head of Unit
Torterotot	Jean Philippe	Cemagref / EWA European Water Association	Deputy Director of Strategy and Research / President
Tripolszky	Sarolta	European Environmental Bureau (EEB)	Biodiversity, Water and Soil Policy Officer
Weiler	Raoul	EU-Chapter Club of Rome	Founder President
Zinkernagel	Roland	City of Malmö / Eurocities	Sustainability Strategist

Scientific advisors:

Harrison	Paula	University of Oxford	Senior Research Scientist
Holman	Ian	Cranfield University	Senior Lecturer
Jäger	Jill	SERI	Senior Researcher
Kok	Kasper	University of Wageningen	Assistant Professor
Metzger	Marc	University of Edinburgh	Senior Research Fellow
Stuch	Benjamin	CESR – University of Kassel	Researcher

Process facilitators:

Gramberger	Marc	Prospex bvba	Lead facilitator
Rakers	Peter	Prospex bvba	Facilitator
Ciamparino	Tommaso	Prospex bvba	Facilitator
Eraly	Emmanuel	Prospex bvba	Facilitator

Annex III: Proposed drivers and main uncertainties

1. Geopolitical stability: The stability of large power blocs, often translated as widespread stable democracy and the absence of large-scale (armed) conflicts.
Low stability: many (armed) conflicts, democracy in some European countries challenged.
High stability: no conflicts, close partnerships, strong and stable EU.

2. Decision-making level: Level at which most important (political) decisions are taken.
Europe dominant: the EU and the European Parliament powerful and steering other levels.
Nation state dominant: Nations are the dominant governing force.
Local dominant: most issues are dealt with at the provincial or municipal level.

3. International cooperation: The cooperation between public and private actors (countries and power blocs (EU, NAFTA)).
Strong cooperation: Strong interaction and exchange of goods, services, and knowledge.
Weak cooperation: Limited exchange of goods, services and knowledge.

4. Social and environmental responsibility of non-state actors: The efforts of non-state actors to maintain or increase – when needed – social, human, or natural capital such as private universities, hospitals, or certification systems (timber, soya).
High responsibility: Non-state actors take a proactive attitude and active role in solving social and environmental problems.
Low responsibility: Non-state actors put the responsibility for social and environmental issues with the public actors.

5. System shocks: The degree to which social, environmental and economic developments are gradual and predictable.
Few shocks: Developments are largely gradual, smooth, without surprises, and therefore predictable.
Many shocks: Developments are largely non-linear and bumpy, and therefore surprising.

6. Population & migration: Population development in terms of natural growth as well as migration patterns.
Migration within regions: Migration will largely take place within (supranational) regions, without major fluxes between continents.
Migration between regions: Migration will largely take place between regions with strong fluxes between continents.

7. Technological innovation: The degree to which new technologies are being developed, tested, and applied.
Pervasive: New technologies are readily available for everyone and everywhere, and innovations take place in many sectors.
Patchy: Technological innovation is either focused on certain sectors or restricted to certain geographical regions.

8. Economic growth: Growth of Gross Domestic Product both in total and per capita.
Gradual: Economic growth will be largely without recessions or excessive increases.
Rollercoaster: Economic growth will include multiple strong recessions and strong rebounds.

9. Choice: The mental process of judging the merits of multiple options and selecting one of

them.
Restricted: Choice is limited by political, financial, institutional, or social factors.
Free: Choice is largely unlimited by political, institutional or social factors.

10. Impact of climate change on human society: The effects of changes in temperature, precipitation, and sea level rise on the functioning of human society.
Low: Climate change impacts on society are low. Human society will not be fundamentally altered.
High: Climate change impacts on society are high. Human society will be fundamentally affected.
(Note: this does not relate to mitigation or adaptation options, but to the fundamental interactions between the social and environmental subsystems).

11. Response of natural systems: The response of natural systems to human-induced changes.
Fragile: Ecosystems are very fragile and any degree of change can lead to their irreversible collapse.
Resilient: Ecosystems are highly resilient and largely makeable; collapse is not irreversible.

12. Attitude towards nature: The attitude of society towards nature.
Instrumental: Nature is perceived as a resource that should be used and it is exploited accordingly to increase financial capital.
Respect: Nature is perceived as a resource that should be protected for future generations and it treated as such.

13. Social behaviour: Behaviour taking place between humans relative to others in a group.
Individualised: Behaviour is highly individual and aims at satisfying individual goals.
Collectivised: Behaviour is highly collective and aims at (also) pursuing goals that benefit the whole group.

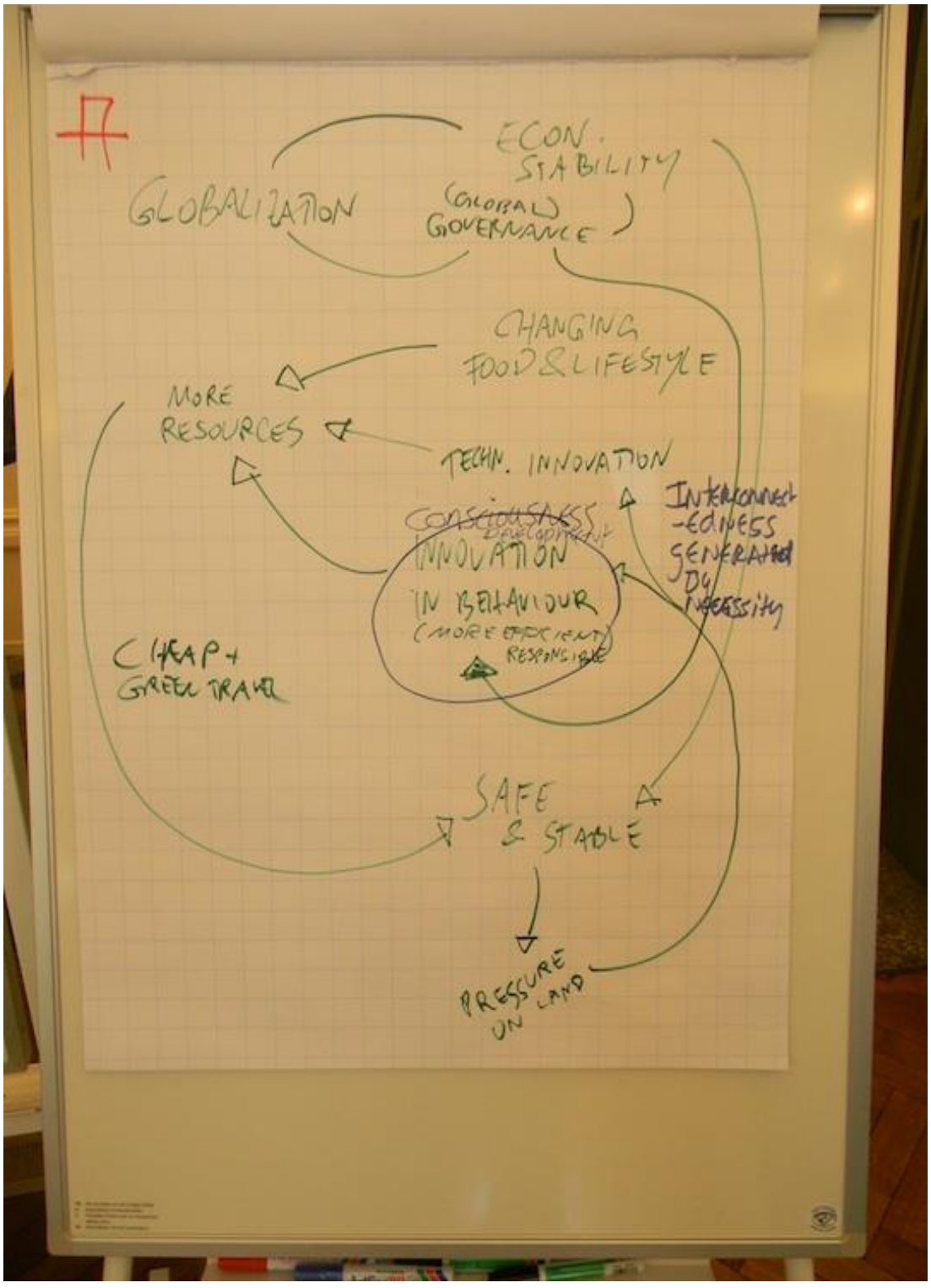
14. Globalisation: The degree to which flows of materials and knowledge are restricted.
Global: There are little to no limitation to flows of materials and knowledge.
Regional: There are strong barriers to flows of materials (e.g. trade barriers) and knowledge (e.g. low degree of technology diffusion).

15. Environmental regulation: The type of environmental laws and regulations, and the way they are implemented and enforced.
Integrated, soft: Regulations are mostly cross-sectoral, address integrated issues (e.g. desertification or climate); and are international. As a result many are soft (i.e. frameworks and directives).
Sectoral, hard. Regulations are mostly sectoral and address specific issues (e.g. water use); and are often national. As a result many are hard (i.e. laws with strict thresholds values).

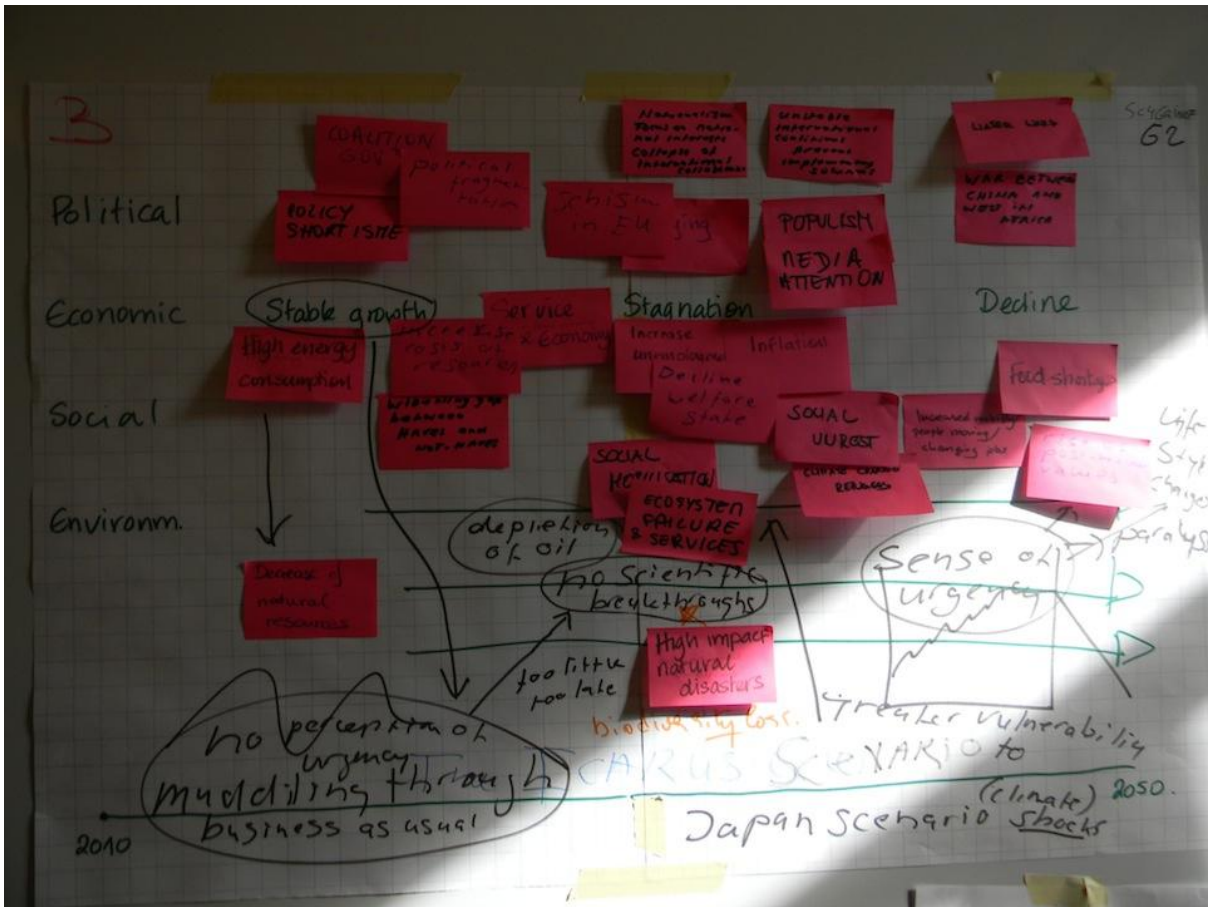
Annex IV: Originial workshop outputs

Original flip-chart and post-its of the “We are the world” scenario elements:

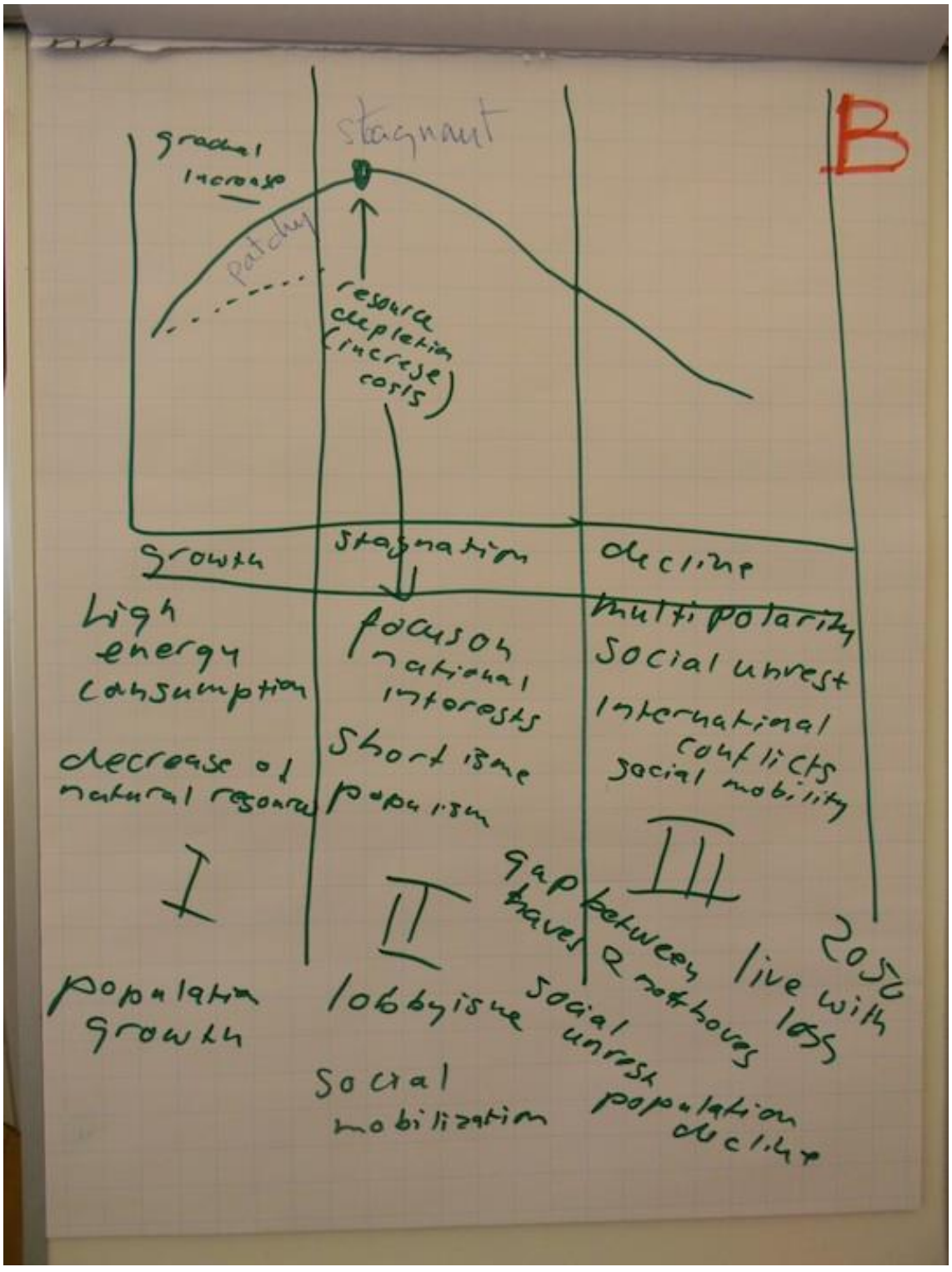
Original flip chart diagram of the “We are the world” scenario dynamics:



Original flip-chart and post-its of the “Icarus” scenario elements:

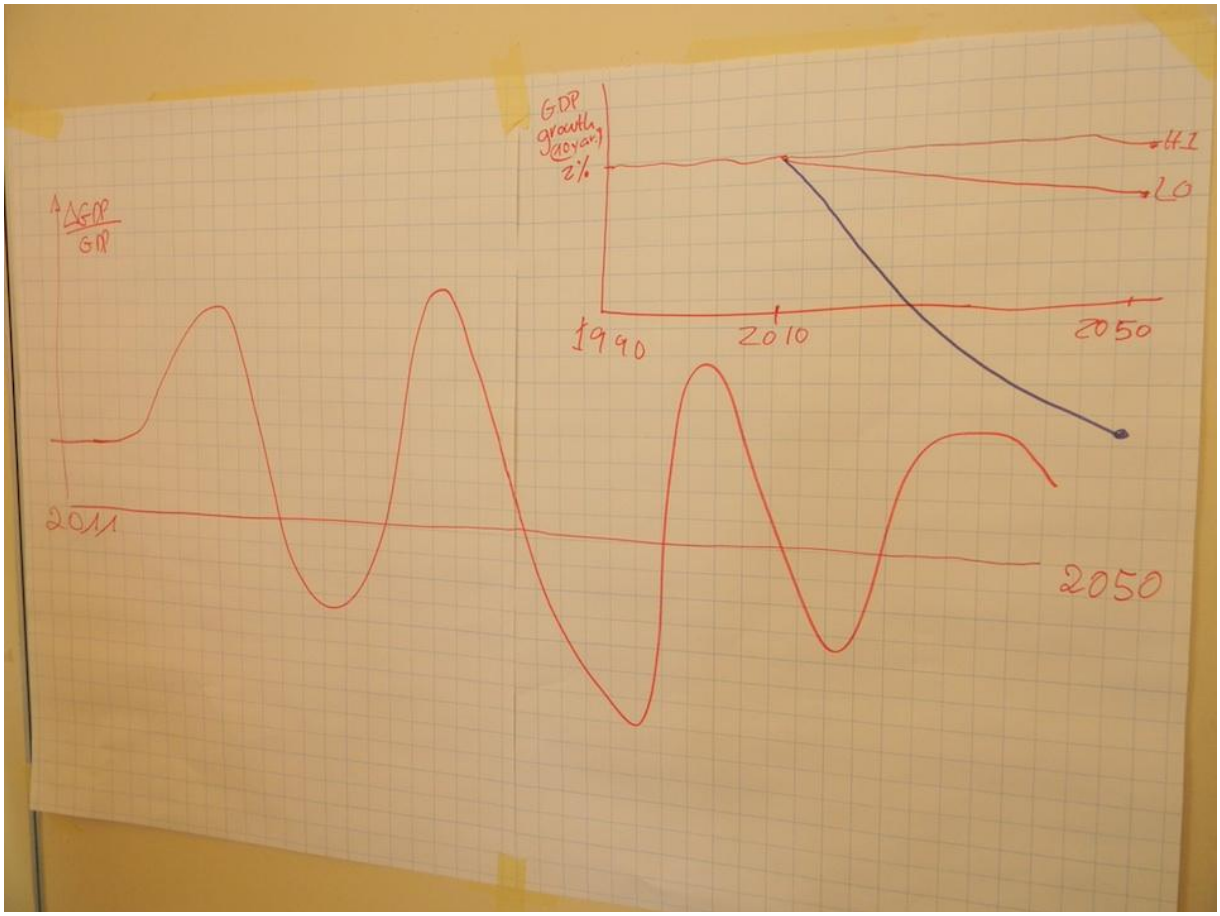


Original flip-chart of the “Icarus” scenario dynamics:



Original flip-chart and post-its of the “Rollercoaster to Armageddon” scenario elements:

Original flip-chart of the “Rollercoaster to Armageddon” additional graphs:



Original flip-chart and post-its of the “I-Ticket to ride” scenario elements:

Original flip-chart of the “I-ticket to ride” scenario dynamics: