Horizon 2020 Societal challenge 5
Climate action, environment, resource
Efficiency and raw materials

D8.4: INTERNAL PROGRESS REPORT AND MINUTES OF THE EAB – MEETING M12

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Table of Contents

Executive summary

Changes with respect to the DoA

No changes with respect to the DoA

Dissemination and uptake

The report is public and for release through the website (www.sim4nexus.eu).

Short Summary of results

This report is a progress report from SIM4NEXUS and minutes of the first meeting of the External Advisory Board, held in Prague on May 30 and 31. The feedback included three parts:

a. Excellent progress is evident with SIM4NEXUS, with the following observations: (i) The project team are very enthusiastic, diverse, well-organised and obviously collaborate well as a team; (ii) the best available research tool are being applied; (iii) there is considerable progress with the work on mapping the science of the nexus and the policy environment; (iv) the diverse range of case studies to be examined with different existing models should provide great insights; and (v) a lot of thought has gone into the communication strategies and indicators.
b. Feedback on modelling, with the following questions: (i) What is the role of the global case study? (ii) Does the energy component consider changing use as well as energy production? (iii) Is the modelling over-reliant on economic projections when prices are too uncertain to be useful? Can hindcasting be used to check the accuracy of the models? (iv) How well does the modelling account for the openness of the systems, with trade, leakage, etc.? and (v) Is the modelling for interactive learning, or for developing projections and scenarios? How will it inform trade-off decisions?
c. Feedback on engagement, with the following questions: (i) There is a risk of appearing either too water centric or so generic as to be unattractive to other sectors. Can the research be positioned with a common 'language' like risk, security and/or sustainable development? (ii) How can the research be more explicitly positioned to inform the big processes, such as the SDG and Paris climate agreement implementation? (iii) Given that there are a number of policy processes that should be informed by this research (e.g. key EU policy reviews), how can project activities more directly engage the governmental staff concerned to generate awareness, ownership and application?

The modelling session took note of the recommendation to adapt the SIM4NEXUS approach to future case studies. The consortium expects that future case studies take less time thanks to the lessons learnt from previous case studies. The engagement session emphasised to use a staged approach from awareness raising to ownership and application. Step 1 on awareness can often easily be done by identifying the desk officers in charge for policy reviews (easy for ENV and CLIMATE, more difficult for AGRI and ENERGY, and by using the calls for evidence and fitness checks of the well-regulated policy processes. Ownership will require more work with desk officers, e.g. organising a lunch presentation or present first results. We might explore handing over a "nexus championship award", maybe with involvement of Commissioner Moedas. A good networking might position SIM4NEXUS also in side-events of COP24, but we have to ask soon for a slot.

Evidence of accomplishment

Report.

Glossary / Acronyms

EAB	EXTERNAL ADVISORY BOARD
IPCC	INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE
IWRM	INTEGRATED WATER RESOURCES MANAGEMENT
KPI	KEY PERFORMANCE INDICATOR
MAGIC	MOVING TOWARDS ADAPTIVE GOVERNANCE IN COMPLEXITY: INFORMING NEXUS SECURITY
SDG	SUSTAINABLE DEVELOPMENT GOAL
UNFCCC	UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE
WSSTP	WATER SUPPLY AND SANITATION TECHNOLOGY PLATFORM

1 Introduction

1.1 Structure of the document

This report presents the agenda and outcomes of the first meeting of the External Advisory Board (EAB), held in Prague on May 30 and 31, 2017. Seven members of the EAB participated and discussed the achievements during the first year with the WP Leads. The program had three parts. First, the activities during the first year are presented by the work package leads and discussed with the EAB (Chapter 2 of the report). This took most of the first day. The EAB then met to internally discuss and prepare an initial feedback (Chapter 3 of the report). This feedback was presented by the Chair of the EAB (Associate Professor Jamie Pittock) at the start of Day 2. The second day did focus on two topics, (i) modelling and (ii) engagement. The two breakout sessions addressed specific items on these topics (Chapter 4 of the report). These were unanimously agreed by the EAB.

Chapter 5 lists the members of the EAB and the participants from the project. Chapter 6 concludes on the next steps. Appendix A has the agenda of the meeting, and the consortium presentations are included in Part B of the deliverable.

2 Presentation of the activities – Day 1

2.1 Introduction to SIM4NEXUS

The meeting of the EAB has five objectives:

1. Direct feedback from the EAB on the project interim and final results
2. Share relevant information about related studies and initiatives with which the EAB is involved
3. Feedback and validation of our methodological approaches and tools
4. Develop relevant ideas with the project team and to ensure linkages with stakeholders and contact with key actors in the field of policy and decision-making related to water, food, energy, land and climate.
5. Ways to connect the stakeholder process in the case studies (WP5) with the other work packages (which largely have a thematic orientation).

The meeting started to explain:

a. Objectives of SIM4NEXUS;
b. Vision of the Nexus of water-food-land-energy-climate;
c. Different case studies and the Serious Game;
d. Expected impacts and Key Performance Indicators (KPIs);
e. Our efforts to create synergies with MAGIC and other projects

The meeting has three parts:

1. Presentation of the workpackages, seeking for feedback (May 30)
2. Meeting of EAB to discuss their observations on the achievements (end of the first day)
3. Interaction of EAB and SIM4NEXUS partners to draft conclusions and follow-up steps, including mobilisation of relevant actors and stakeholders on the Nexus issues (May 31).

The following sections summarise the discussions from the topics that are presented (See Annex A for the agenda of the meeting).

2.2 Understanding and assessing the Nexus

In general, members of the EAB had a lot of very valuable comments on the material presented on Work Package 1. Many of the comments converged on similar issues, as different members of the EAB brought them up:

- The analysis in SIM4NEXUS should not be seen as a static approach and should definitely take society into account. An important question that needs to be addressed is what are the implications for society? How will the science of the nexus be used by society? Or how will the science be used to help society address these very important environmental issues? It was suggested by the EAB that it would be interesting to device and develop the "Nexus way" of addressing these issues.
- The EAB reiterated the previous comment about seeking the consequences on society and focusing on them; it was emphasized that social expectations regarding pressures on resources are important and should be addressed. The EAB made also some specific comments about the analysis in WP1: climate could and should be considered a resource (just like water, energy, land and food). This can be achieved by treating climate as a carbon budget that increases or decreases depending on fossil fuel use, carbon sequestration, etc. On the economic analysis, it was suggested that we should view economics as the science of scarcity and the science of allocations and not only focus on economic growth. In addition feedback loops are important and should be included when we further analyse results of the thematic models.
- The EAB advised that we might want to see whether there could be a function that we could develop that will treat the system in a continuous way (as opposed to a discrete analysis). Such a function could be useful for the general representation of the Nexus tree with all the interdependences of the nexus dimensions and all the interlinkages.

2.3 Policy analysis and the Nexus

WP2 is outlined, and the findings of D2.1 ('Policies and policy coherence at global and EU scale') are presented. The work is well received. The following remarks were given:

- Windows of opportunity to influence policy making can be very precise, days, weeks, months. Discussions about policy reviews in 2020 have already started in 2017. To have impact, SIM4NEXUS should make itself known at the Commission and stay connected.
- WP2 will make timelines of SDGs, IPCC and UNFCCC processes, to find moments to plug in SIM4NEXUS results.
- To reach a more coherent policy, governments have the following organisational choices: (i) establish a central agency, in charge of the common policies; (ii) cross-compliance; and (iii) bottom-up, capacity building, to reach cooperation organically.
- SIM4NEXUS will not analyse the decision-making process at EU and global scale, but focuses on the resulting policies, written in policy documents. The implementation practice and process will be analysed at national and regional scale, in the cases. These may lead to recommendations about the policy making process, bottom-up.
- First generation biofuels made from food and feed crops will be phased out. The scenarios for 2020, 2030, 2050 should make assumptions about the speed of introduction of 2nd and 3rd generation biofuels. Proposed EU targets are max. 7% of total energy used for transport in 2020 and max. 3.8% in 2030.
- Local and global issues and policies are linked. Agriculture is a very open sector, so trade policy is important and there are spin-offs of EU import and export elsewhere in the world. Virtual water and water footprints link local and international scales. Scarcities elsewhere in the world may have effects on Europe, e.g. refugees. See 'Shared Vision, Common Action: A Stronger Europe. A Global Strategy for the European Union's Foreign and Security Policy'. http://eeas.europa.eu/archives/docs/top_stories/pdf/eugs_review_web.pdf. And EC Strategy plans 2016-2020 https://ec.europa.eu/info/publications/strategic-plans-2016-2020_en. Also see Mistra, a project by SEI that runs from 2017-2020 https://www.sei-international.org/mediamanager/documents/Projects/SEI-2017-FS-Mistra-Geopolitics.pdf.
- The method used for coherence analysis is appreciated, but the real coherence problems will pop up during implementation, at the level of policy means and instruments. Here the real effects will show. This will be investigated in the national and regional cases.
- To point out conflicts in EU policies is considered useful. Although conflicts resolution mechanisms exist within EC, SIM4NEXUS results may enhance these mechanisms.
- To get advices heard, frame issues as 'risks', 'valuing land and water', 'how to design and operate infrastructure', e.g. financing. Also discuss flexibility of policies over time, to avoid lock-inns.

2.4 Thematic models and the case studies

The thematic models and their application to the case studies were presented. The EAB agreed that the diverse range of case studies to be examined with different existing models could provide great insights. They appreciated that we identified models already operational and used for impact assessment, mainly at the EU level. The following remarks were given:

- What is the role of the global case study? The consortium explained that the global case does focus on global challenges and international trade features connected to the Nexus: achievement of the Sustainable Development Goals (SDGs) (especially the ones related to food, water, energy, biodiversity), low-carbon energy and climate change mitigation, and its effects on land, water, food, biodiversity.
- Is the modelling over-reliant on economic projections when prices are too uncertain to be useful? Can hindcasting be used to check the accuracy of the models? Here, the consortium clarified that uncertainty will be taken into account in WP3 later on, as it is foreseen in the DOA. We will explore the potential of using hindcasting.
- How well does the modelling account for the openness of the systems, with trade, leakage, etc.? The global and European cases account for trade issues. As projections from European and global models will be also used in national-regional cases, openness of the systems will

be considered (at least partially) in all case studies. Virtual water, for instance, could be used as an indicator of the degree of openness.

The WP5 presentation explains the place of the case studies within SIM4NEXUS. The cases are shortly presented as well as their achievements in the 1st year. Advice from the EAB is welcome on the Global and European case studies, on the transboundary case studies, as well as on defining indicators of success.

- The EAB requested to learn how SIM4NEXUS will reach a wider audience and spread knowledge of the Nexus. The audience must be at a lower but broader level. So far, the project targeted only experts of the different sectors in the Nexus, primarily because we are looking for questions and data at the case study level. But we have in mind to target a broader public, especially decision-makers and students.
- The EAB proposed to develop different storylines to align to each person's perspective. Especially in the transboundary situation where there are cultural differences. As regards the definition of "success" : remember that your goal is that the stakeholders take an informed decision. So the success is how the parties describe a problem, understand it and address it. Related to this, a "success" is when behaviour is changing. Success is seen through (i) legal obligations, as well as (ii) governance and funding agreements. Therefore the case study should investigate how to influence these. "Success" also means cooperation across sectors or across boundaries. The challenge in the transboundary cases is to find enough data, and which is comparable. The modelling done in SIM4NEXUS could help overcome this problem and point-out the common issues and solutions, therefore improving cooperation.
- The EAB wonders what kind of 'decision' you are targeting when aiming at 'improving decision making in the 12 case studies' ? And what would that mean for the Global case ? There are no 'decision' nor operational policies taken at this level. Finally, there seems to be a strong bias of the case studies towards water. This bias should be overcome, otherwise, it is only IWRM. Success would be behavioural change, change in governance, and spreading lessons from the project. The consortium responded that the case studies cover the nexus of water, land, food, energy and climate, and can be divided into an group focussing on energy issues, and a group more focussed on water. Not all case studies are focused on water.
- As regards the Global, European and transboundary case studies, the EAB recommends to focus on their specific features and potential: we could explore why there is no transboundary energy organisation (by comparison to international river organisations). It is recommended the governmental and institutional organisations have a stronger role in the transboundary cases to understand this.

2.5 System dynamics modelling and the Serious Game

During the EAB meeting, several questions and issues related to WP3 and WP4 were discussed.

- The EAB asked how food and energy price data was going to be calculated and how models can project this data, taking into account that the aim is to assess a future change, how is it possible to track these changes using data from the past. The consortium explained the soundness of the Thematic Models and how they can be used to project future scenarios taking into account many variables that can predict and provide useful data about climate, energy and food for 2030 and 2050.
- The EAB centred next question in how Serious Games can match with the needs and goals of different Policy Makers, wondering how could the Serious Game be reused in different scenarios. The main aim was to discuss how by playing the Serious Game, policy makers can be assessed or helped in their goals. The consortium explained how some of the Thematic Models are already used to assess in the development of new policies in the EC. The consortium provided a detailed explanation of the validity of the approach used in SIM4NEXUS. The consortium also provided some explanations about the approach used to

develop de Serious Game, and how different Case Studies would be developed in the future by taking advantage of scalability and customization principles.

- The EAB asked if the ultimate aim of the Serious Game was whether to provide an answer to what will happen in the future or to provide an answer two different "what if" scenarios. The Consortium explained previous experiences with Serious Games. More concretely, the Consortium explained how Aqua Republica is used in several training and educational workshops. The consortium explained how during this sessions, the players can set up different scenarios to reach goals and learn while they play and try to achieve some objectives. A video of Aqua Republica was shown, where the whole experience could be seen.
- The EAB asked what was the difference between Aqua Republica and SIM4NEXUS Serious Game, wondering if the difference was that one is an awareness based tool and a decision based tool. The consortium explained that SIM4NEXUS Serious Game was more focused on the policy making process. However, an interesting discussion about the use of the Serious Game as a risk assessment tool started, stating that in that case many other suitable exploitation cases could arise and many other user profiles could exist such as green investors, assurance companies, among others. A discussion regarding the possibility of adding new policies to the game was done. WP4 will devote efforts in finding a way for policy representation, making the other modules compatible with this format, and allowing dynamic User Interface adaptation to the set of policies. However, this policy representation will try to be as generic as possible, and big differences or usages from the SIM4NEXUS tool requirements may imply changes at other levels.
- The EAB and the Consortium started a discussion about if the approach used in SIM4NEXUS could be used by MAGIC NEXUS project. Although the EAB explained that the approaches had strong similarities, the main difference is that MAGIC approach is based on the hypothesis that in the future society's use of energy it is unlikely to be the same so it's improbable that predictions based on past data will be useful.
- The EAB was interested in knowing whether Games Theory practices are being used or not. Although they aren't used directly, the game is using a bonus/malus approach, very close related to the Nash Equilibrium concept. Therefore, in order to gain usability and engagement, applying these concepts will be considered.
- The EAB asked how we are going to implement constraints in the game. Several approaches are discussed such as rule based engines or constraint satisfactory problem solvers. However, this decision is postponed till the tool is in a more advanced state.
- An issue regarding how concepts and entities are named across WPs and stakeholders arose. It is agreed that a naming convention (on the work under WP4) is necessary to homogenise terms and their corresponding definition. Moreover, the Semantic repository will be used to store that concepts, and make them available to the other modules, and scientific community in general when necessary.
- The possibility of relating the game learning goals and objectives to the achievement of SDGs was discussed, and will be further developed in future discussions across WPs.

2.6 Communication and outreach

The following issues were discussed at the EAB meeting on the WP7, during the plenary session:

- We should approach policy makers only if we have a good big message on results, not just for selling the project. We should work towards the policy opportunities (the process should address over time awareness, ownership and application), starting conversation asap as our findings are relevant for them. It might be interesting to publish the calendar of policy opportunities (from WP2).
- WP2 could develop a database of key policy contacts, to get an idea whom we can address or not
- Our network and focus might be too water-centric, resting impact on other sectors. We might want to link nexus engagement strategies to terms like "risk" or "security" – risk can raise interest ("wake up call") from other sectors than water on the nexus, because other wording like benefits, opportunity is not seen as relevant by those sectors. The massive changes due to

the nexus are not necessarily perceived. Use “risk” and then turn it over to positive proposals. The modelling part for risk assessment (likelihood, uncertainty) is not yet done, and will be available by 2018.

- The website does not look as a tool to engage/attract people. If this is aimed (note, it is not aimed in the current strategy), it should be revised.
- The use of languages in the case studies adds further complexity to communications.
- Regarding the different target audiences, we might want to think about reserving a part of the budget/effort for communicating with the general public, to widen up the audience/knowledge on the nexus beyond a currently very limited group, raising awareness about the nexus-related problems/risks. Use an easy newspaper style.
- From WP6: interested sectors in the serious game are: construction, water utilities, EU institutions and National ministries. Energy and insurance are not interested. This might be relevant for selecting communication tools.

2.7 Exploitation impact and SIM4NEXUS business plan

The EAB welcomed the work achieved by WP6 during the first year to generate ideas of usages and commercial outputs for SIM4NEXUS research. The main feedback related to the applicability of SIM4NEXUS in green finance. Long-term investors like pension funds, institutional investors, sovereign funds and green banks are highly interested in new methods to assess environmental risks. Labelling projects using a certified and uniform methodology based on SIM4NEXUS could be a relevant business model. Partnerships may be envisaged with Climate Bond Initiative (CBI) (which certifies climate resilient projects) and Carbon Disclosure Programme (which assesses carbon emissions in a harmonized manner). CBI’s shareholding model bringing together 4,000 fund managers together is highly efficient to facilitate the access to finance for the projects labelled by CBI. Currently in green finance, in addition to green bonds related to climate, blue bonds related to water are being developed. CBI and CDP do not use any scientific model as robust as SIM4NEXUS’s one. The EAB recommended to approach Chief Sustainability Officers in large industrial companies. CSO link climate and strategy in such companies.

3 Initial feedback from EAB

The EAB prepared an initial feedback following presentations on progress by SIM4NEXUS Work Package leaders on 30 May 2017. Five EAB members contributed to this feedback: Alexandre Verbeek, Iakovos Ganoulis, Jamie Pittock, Mario Giampietro, Xavier Leflaive.

Feedback was presented by the chair of the EAB, Associate Professor Jamie Pittock. The feedback included three parts:

d. Excellent progress is evident with SIM4NEXUS, with the following observations:
   - One year into a four year project;
   - The project team are very enthusiastic, diverse, well-organised and obviously collaborate well as a team;
   - The best available research tool are being applied;
   - There is considerable progress with the work on mapping the science of the nexus and the policy environment;
   - The diverse range of case studies to be examined with different existing models should provide great insights;
   - A lot of thought has gone into the communication strategies and indicators.

e. Feedback on modelling, with the following questions:

- What is the role of the global case study?
- Does the energy component consider changing use as well as energy production?
- Is the modelling over-reliant on economic projections when prices are too uncertain to be useful? Can hindcasting be used to check the accuracy of the models?
- How well does the modelling account for the openness of the systems, with trade, leakage, etc.?
- Is the modelling for interactive learning, or for developing projections and scenarios? How will it inform trade-off decisions?

f. Feedback on engagement, with the following questions
   - There is a risk of appearing either too water centric or so generic as to be unattractive to other sectors. Can the research be positioned with a common 'language' like risk, security and/or sustainable development?
   - How can the research be more explicitly positioned to inform the big processes, such as the SDG and Paris climate agreement implementation?
   - Given that there are a number of policy processes that should be informed by this research (e.g. key EU policy reviews), how can project activities more directly engage the governmental staff concerned to generate awareness, ownership and application?

Two break-out groups were agreed to work on modelling and engagement.

4 Break-out sessions - Day 2

4.1 Modelling

The modelling session has covered two main aspects:

- Firstly, it was decided to cover and discuss question 4 from EAB feedback, which states "How well does the modelling account for the openness of the systems, with trade, leakage, etc.?" After an interesting discussion two main recommendation from the EAB were provided.
- The first one regarding the use of bio-physical flows for energy, food and water in the modelling background of SIM4NEXUS. The consortium took note of this recommendation stating that these flows are included in the current work ongoing in Thematic Models.
- The second recommendation concerns the increase of the openness of not only the global and continental case studies but the EAB also recommends that national, regional and trans-boundary case studies benefit from this openness.
- Secondly, the session was focused on the adaptability of the SIM4NEXUS approach to future case studies. The consortium took note of this recommendation and explained that although Sardinia Fast track has taken some months to be developed it is because it has been thought as an initial case study which will serve as example for further case studies. The consortium exposed the example of the Greek case study, which is already in development just after the Sardinian case, and the consortium remarked that thanks to the adaptable and extensible approach used in Sardinia, the Greek case has been developed in much less time. The consortium expects that next case studies cost even less time thanks to the lessons learnt from previous case studies (Sardinia and Greece), as the lessons learnt during these development will help to overcome future issues.

4.2 Engagement

Furthermore, during the "engagement-focused" break out session, we additionally had the following thoughts:

- On risks: concept of risks is a very useful tool to engage stakeholders, e.g. governments or business that face a risk to not achieve their targets/projects (e.g. 2ºC). Additionally, within the

remaining project duration, it is quite expectable that we will face in case study areas or the EU some extreme situations (variability, like floods, droughts, energy short fallings) leading to risks and vulnerability of the nexus sectors. Maybe we should prepare the communications and policy materials for addressing such opportunities, and launch them when they occur.

- On targeting SDGs and the Paris agreement, SIM4NEXUS might offer a way to governments to report to these processes, based on the data and modelling done within our project. We might want to consider how to engage in such reporting exercise and strengthen thus relationship with National governments, and turn research results to official reports. Additionally, the SIM4NEXUS-based reporting might be highlighted in international reports as good practice, and facilitate peer-to-peer communication. These are opportunities to be explored under WP2, supported by WP7
- Regarding the policy processes in the EU, it appears fundamental to use a staged approach from awareness raising to ownership and application. Step 1 on awareness can often easily be done by identifying the desk officers in charge for policy reviews (easy for ENV and CLIMATE, more difficult for AGRI and ENERGY, and by using the calls for evidence and fitness checks of the well-regulated policy processes. Ownership will require more work with desk officers, e.g. organising a lunch presentation or present first results. We might explore handing over a "nexus championship award", maybe with involvement of Commissioner Moedas. A good networking might position SIM4NEXUS also in side-events of COP24, but we have to ask soon for a slot.

5 Participants and membership

5.1 Members of the EAB

Name - Organisation	
Iakovos Ganoulis Special Secretary for water in the Ministry of Reconstruction of Production, Environment & Energy, Greece	Advise on the process of integrating policies related to food, water, energy, land and climate.
Kitty van der Heijden World Resources Institute (WRI)– Director WRI - Europe	Advise on the process of integrating policies related to food, energy, water, land and climate. In order to cope with these challenges and to understand the Nexus, a common transnational approach is seen most advantageous
Xavier Leflaive Organisation for Economic Co-operation and Development (OECD), Water team leader in the Environment Directorate	Process of integrating policies related to food, water, energy, land and climate, with focus on policy coherence, the use of economic instruments and the political economy of reform
Jamie Pittock Australian National University, Canberra	Australian perspective and research findings on the management of the complex inter-

	dependencies of the Nexus, as well as experience in the United States
Patrick Reed Professor of Civil and Environmental Engineering at Cornell University	Process of integrating policies related to food, water, energy, land and climate. Focus on risk management, multi-sector trade off analysis, and state-of-the-art approaches for understanding key multi-sector dependencies
Alexander Verbeek Associate at Stockholm Environment Institute (SEI) and at Stockholm International Water Institute (SIWI)	Global issues related to climate, security, water, food, energy and resources.
Albert Vermuë Secretary-General of the European Union of Water Management Associations (EUWMA)	The water component of the Nexus and keen to seek ways for improving the integration of water policies across the European, national and regional scales
Mario Giampietro ICREA Research Professor at Institute of Environmental Science and Technology, ICTA	Project coordinator of the H2020 project 'Moving towards Adaptive Governance In Complexity: informing Nexus security (MAGIC)'

Kitty van der Heijden (WRI) and Patrick Reed (Cornell University) had to decline their participation. Also, Albert Vermuë was only able to participate on May 30.

5.2 Participants from the project

Name - Organisation	RESPONSIBILITY
Floor Brouwer (WUR-LEI)	WP8 – Lead, Scientific Coordinator and WP5 – Lead
Chrysi Laspidou (UTH)	WP1 – Lead
Maria Witmer	WP2 – Lead
Jan Pokorný Local partner ENKI in SIM4NEXUS	Participant of the first EAB Meeting
Marianne Selten Assistant project-leader in SIM4NEXUS	Member of the core team in WUR-LEI
Lydia Vamvakeridou-Lyroudia	WP3 – Lead

Maria Blanco	WP3 – Co-Lead
Xavier Domingo and Francesc Guitart, replacing Gabriel Anzaldi	WP4 – Lead
Maïté Fournier	WP5 – Co-Lead
Alexandre Bredimas	WP6 – Lead
Guido Schmidt	WP7 – Lead
Chengzi Chew	WP6 – Co-lead (Serious Game)

6 Conclusions and recommendations

Many useful comments and recommendations were discussed during this first meeting of the EAB. They serve as input into the project review. Following the review, the consortium will conclude on follow-up steps from the project review and the topics addressed during the EAB.

Appendix A: Agenda EAB – May 30 and 31

Tuesday 30 May 2017

Item	Time	Agenda topic	Expected results
1	8.45	Early morning coffee/tea/refreshments	Greetings
2	9.00	Welcome and tour-de-table of the participants; program of the two days	Getting to know each other and confirm the program
3	9.45	SIM4NEXUS – a short introduction: Floor Brouwer	Clarify ambitions, structure and mode of working in SIM4NEXUS
4	10.15	Coffee/tea/refreshments	Recover
5	10.30	Understanding and assessing the Nexus: Chrysi Laspidou	Feedback from EAB on the science of the Nexus. A presentation of 15 minutes, followed by discussion
6	11.30	Policy analysis and the Nexus: Maria Witmer	Feedback from EAB on the policy analysis. A presentation of 15 minutes, followed by discussion
7	12.30	Lunch	Batteries are recharged for the afternoon
8	13.30	Thematic models and the case studies: Maria Blanco and Maïté Fournier	Feedback from EAB on the models and the case studies. A presentation of 15 minutes, followed by discussion
9	14.30	System dynamics modelling and the Serious Game: Lydia Vamvakeridou-Lyroudia, Xavier Domingo and Francesc Guitart	Feedback from EAB on the modelling tools and Serious Game. A presentation of 15 minutes, followed by discussion
10	15.30	Coffee/tea/refreshments	Recover
11	16.00	Communication and outreach: Guido Schmidt	Feedback from EAB on the communication strategy. A presentation of 15 minutes, followed by discussion
12	17.00	EAB to plan for Wednesday morning	EAB will meet to discuss their observations and clarify their expectations for the second day.
13	18.00	City walk and dinner in town	

Wednesday 31 May 2017

Item	Time	Agenda topic	Expected results
14	8.45	Early morning coffee/tea/refreshments	
15	9.00	Feedback from EAB	What has been achieved in SIM4NEXUS and what are the plans for the coming year? How to improve stakeholder involvement in SIM4NEXUS activities?
16	10.00	Exploitation impact and SIM4NEXUS business plan: Alexandre Bredimas	Feedback from EAB on the exploitation and business strategy. A presentation of 15 minutes, followed by discussion
17	11.00	Coffee/tea/refreshments	
18	11.15	Two parallel groups to draft conclusions and follow-up steps, including mobilisation of relevant actors and stakeholders on the Nexus issues	EAB and WP leads discuss conclusions
19	12.15	Conclusions and next steps	EAB is requested to provide a short note from the meeting, with their findings, which are hopefully unanimously agreed
20	13.00	Lunch and departure	

Appendix B: Presentations from consortium

SIM4NEXUS – a short introduction

EAB – May 30 & 31, 2017

Floor Brouwer

WUR-LEI

30/05/2017

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 689150 SIM4NEXUS

EAB meeting has five objectives

- Direct feedback from the EAB on the project interim and final results
- Share relevant information about related studies and initiatives with which the EAB is involved
- Feedback and validation of our methodological approaches and tools
- Develop relevant ideas with the project team and to ensure linkages with stakeholders and contact with key actors in the field of policy and decision-making related to water, food, energy, land and climate.
- Ways to connect the stakeholder process in the case studies (WP5) with the other work packages (which largely have a thematic orientation).

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SIM4NEXUS project

- Sustainable Integrated Management FOR the NEXUS of water-land-food-energy-climate for a resource-efficient Europe (SIM4NEXUS)
- Grant of M€ 7.9
- Started June 2016, with a duration of 4 years; 25 partners from 15 European countries
- EAB is foreseen to meet three times

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SIM4NEXUS

SIM4NEXUS will

- Develop a Serious Game, operable at different scales ranging from regional to national, to continental, to global, as well as different time horizons: short, medium and long-term
- Facilitate the design of policies and bridge knowledge and technology gaps in the field of the water-land-food-energy-climate Nexus under climate change conditions.
- Adopt a network of regional and national case studies in Europe as a test bed for achieving resource efficiency through successful Nexus compliant policy initiatives. In this context, SIM4NEXUS will address the barriers of expanding the use of the Serious Game by end-users and policy-makers.

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How to improve resource efficiency?

- Resource efficiency requires knowledge on how related sectors operate: how to create synergies in the water sector with energy, food, land and climate?
- The Nexus approach enables to mitigate trade-offs and exploit synergies among the sectors of water, energy, food, land and climate. Economic benefits are achieved through a more efficient use of resources, create productivity gains and reduce waste
- A Serious Game is developed to learn from modelling tools, using impact assessment approaches and expert knowledge. On top of it, a user will benefit from the knowledge of practitioners who play the game. We develop the game through 12 cases across Europe

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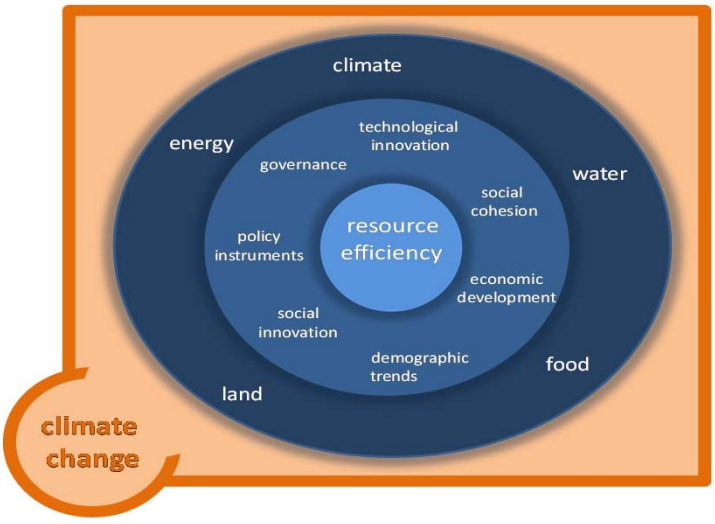
Our vision of the Nexus



Different Case Studies

- To achieve a detailed understanding of the scientific interrelations between the components of the Nexus.
- To represent different spatial scales (regional, national, continental and global)
- To assess the benefits of synergies in policies when decision makers address the Nexus concerns.
- To assess relevant near-term policy initiatives. This assessment will be accompanied by sensitivity analysis in the case studies, to reduce uncertainties and increase the reliability of the scenarios.
- To propose the potential for transferability of the case study to other regions and countries.
- As test beds of the models and the Serious Game

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The Serious Game

SIM4NEXUS to develop a Serious Game

- With an Innovative Knowledge Elicitation Engine (KEE)
- Based on Aqua Republica (an existing serious game focusing on water developed by DHI)
- http://www.dhigroup.com/upload/publications/scribd/1726290 15-Exploring-the-World-of-Aqua-Republica-DHI-Case-Story.pdf

Screenshot of Aqua Republica's interface. © DHI

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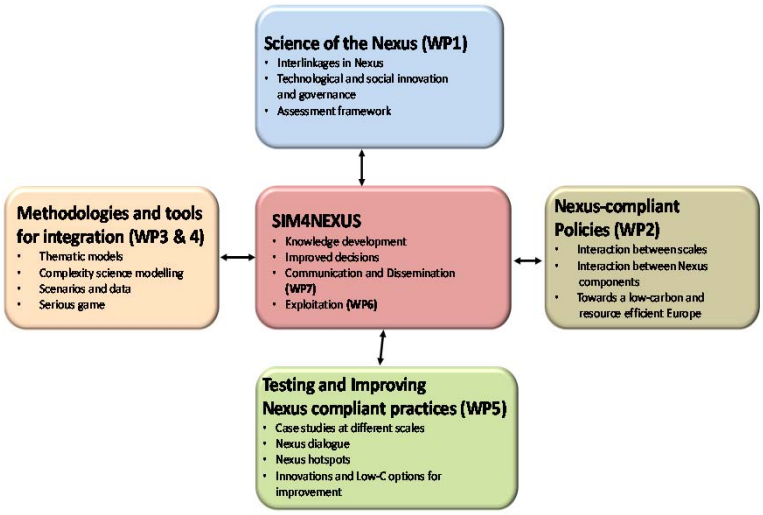
The SIM4NEXUS workflow



Expected impacts

- Increased understanding of how water management, food, biodiversity and land use policies are linked together and to climate and sustainability goals
- Reduction of the uncertainties about the opportunities and limitations of low-carbon options, such as bioenergy technologies and resource efficiency measures, in view of relevant near-term policy initiatives
- Contribution to future assessments, including those of the IPCC, with multidisciplinary and integrated tools

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Key performance indicators (KPIs)

- KPI1 – How many pathways are developed in the 12 case studies in achieving the 2050 vision ('Living well within the borders of our planet'), climate and sustainability goals and opportunities and limitations of low-carbon options in view of near-term policy initiatives. We judge that a higher number of pathways is better.

- KPI2 - Number of papers by SIM4NEXUS partners submitted to peer reviewed journals that present the link between the Nexus and resource efficiency, pathways for the vision 'Living well within the borders of our planet' in 2050 and beyond, climate and sustainability goals and opportunities and limitations of low-carbon options in view of near-term policy initiatives

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Key performance indicators (KPIs)

- KPI3 - Number of tweets from @SIM4NEXUS (with 'likes', 'retweets' and 'views') that address the links between the Nexus and resource efficiency, pathways for the vision 'Living well within the borders of our planet' in 2050 and beyond, climate and sustainability goals, and opportunities and limitations of low-carbon options in view of near-term policy initiatives.

- KPI4 – Are complexity science modelling tools operational for all case studies (Yes/No)? Present the number of cases that have

- KPI5 - Percentage of respondents in the case studies who reply positive towards the question whether they have gained insights on the Nexus and Nexus-compliant practices.

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Key performance indicators (KPIs)

- KPI6 - Number of end-users who have adopted the Serious Game during the life-time of the SIM4NEXUS.
- KPI7 – Is there a governance structure in place to maintain and further develop SIM4NEXUS Serious Game (e.g. new partnerships that result from SIM4NEXUS; number of users of the Serious Game who pay for its use)?
- KPI8 – Number of contributions towards international policy events (UNFCCC – United Nations Framework Convention on Climate Change, CBD - Convention on Biological Diversity), European (e.g. CAP – Common Agricultural Policy, WFD – Water Framework Directive), national policy events and regional policy events.

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Create synergies with MAGIC and other projects

1. Membership of the two Advisory Boards
2. Jointly co-ordinate Nexus working group of European Water Supply and Sanitation Technology Platform (WssTP)
3. European policy workshop on the Nexus
4. Develop a common case study
5. Science event on the Nexus
6. Outreach in major climate change events
7. Joint communication strategy on the Nexus (e.g. through twitter accounts)

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Three modes of interaction

All workpackages are presented during the meeting – we seek for feedback from the EAB on the project results

EAB to meet on Tuesday afternoon (5 pm), to discuss their observations and expectations for the second day. We would appreciate EAB to chair the second day

Interaction of EAB and SIM4NEXUS partners to draft conclusions and follow-up steps, including mobilisation of relevant actors and stakeholders on the Nexus issues . For presentation on Wednesday morning

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Partners

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Thanks for your attention!

For further information please consult
www.sim4nexus.eu,
follow us at @SIM4NEXUS

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WP1-Science of the Nexus

1st EXTERNAL ADVISORY BOARD (EAB) meeting in Prague, Czech Republic

Chrysi S. Laspidou,
Associate Professor

University of Thessaly

13/05/17

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Major Deliverable in Year 1

Task 1.1: Compose a thorough literature review on the interlinkages of Water-Energy-Food-Land-Climate and Climate Change, aiming at a quantified analysis. Low-carbon options will also be reviewed in this Task. The result will be a ***Scientific Inventory*** to be used throughout the project. The literature review will take a holistic approach and will focus on the resource base, including both biophysical and socio-economic resources, on which we depend to achieve social, environmental and economic goals pertaining to the Nexus under climate change. Since our analysis is stakeholder-driven, rather than driven by the experts, we consider a range of drivers that are relevant to the case studies. The influence of Climate change is given special emphasis and is considered separately to show the effect of climate scenarios on all quantified interlinkages.

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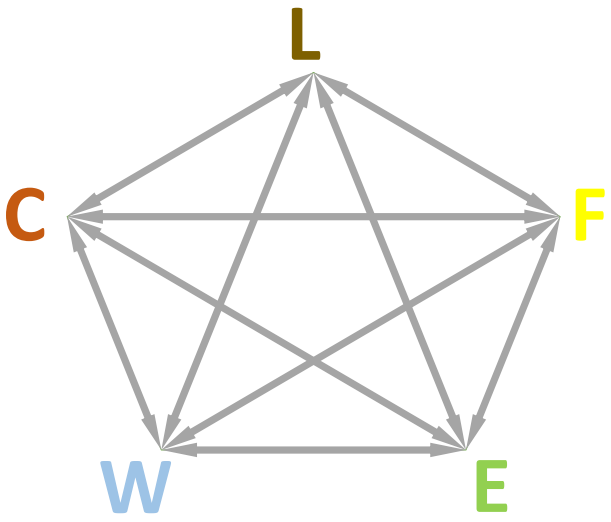
University of Thessaly

The interlinkages within the Nexus



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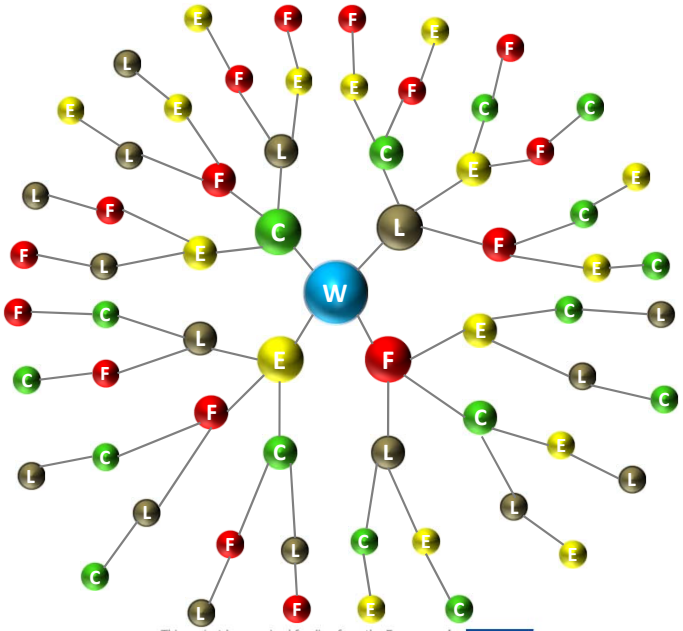
The interlinkages within the Nexus



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Defining the Nexus domains

Water is:

- the water system, hydrological cycle, habitat for species, aquatic ecosystem, with characteristics e.g. discharge (patterns), water level, morphology of water body, precipitation and evapotranspiration(patterns), chemical and ecological quality, biodiversity.
- a natural resource, water use for all sorts of human needs, with quantity and quality, emissions, discharges, withdrawal and consumption, water footprint. Water quantity and quality are affected by human use, either on purpose – water management- or as a (negative) side effect.
- Water as a geographical phenomenon, lines (canals and rivers) and surfaces/areas that connect, are used for transport and offer room for activities.

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Defining the Nexus domains

Land is:

- The land and soil system, with its cycles of nutrients and organic matter, habitat for species, terrestric ecosystems, with characteristics e.g. soil type, slope, biodiversity.
- A natural resource, land use, with quantity and quality/intensity, land footprint. Land and soil are affected by human use, either on purpose – land management, agriculture-, or as a (negative) side effect, e.g. erosion and degradation, sealing, salinization.
- Land as a geographical phenomenon, 'room' for living, acting and transport e.g. urbanization, industrial areas, roads, spatial planning.

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Defining the Nexus domains

Food is:

- Food production, primary (agriculture) and secondary (industrial food processing).
- Food consumption.
- Supply chains, trade, markets, prices & price volatility.

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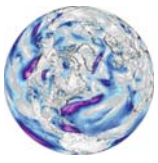
Defining the Nexus domains

Energy is:

- energy production, primary & mining, secondary e.g. coal into electricity.
- Energy consumption.
- Energy production and consumption are connected through energy transformation from one form to another, supply chains and networks, trade, markets, prices.

Climate is:



- The long term pattern of the weather.

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Nexus interlinkages summary table

	Water	Energy	Land Use	Food	Climate
Water		• Water is required for fossil fuel extraction. • Water is required for fuel processing. • Water is required for biofuel cultivation and processing. • Water is used in the transportation sector. • Water is used in electricity generation. • Water is used in hydropower generation. • Water is used in thermal power generation (fossil fuel and nuclear). • Water is used by non-hydro renewable energy technologies.	• Water played and plays a vital role in the determination of the location of man's settlements. • Artificial surfaces such as urban and industrial areas are developed in the neighborhood of rivers or other sources. • Water abundancy determines the type of crops or livestock that can be raised at different places. • The seasonal flooding of river floodplains determines the land's productivity by natural fertilization. • Irregular flooding of rivers threatens human settlements and croplands. • Rainfall predetermines (together with solar radiation and temperature) the predominant type of vegetation. • The amount of available water controls the existence of forests and semi-natural areas. • Wetlands are vital for maintaining water availability and increasing the resilience of agriculture to survive extreme water events. • Natural water purification is served by inland water bodies and wetlands. • Inland water bodies and wetlands can be used for aquaculture or recreational activities.	• Crops require water for photosynthesis. • The water requirements of crops vary considerably, as do irrigation efficiencies. • Animals need water to drink (and indirectly for the production of feed). • Fish need water as habitat. • Reaching food security targets depends highly on the physical access to water and on water quality. • Oceans play role in marine fisheries, lakes and rivers in freshwater fisheries and aquaculture. • Green and blue water are used in land- based food production. • Sufficient water, in combination with well-maintained and organized irrigation systems, can be a huge boost to food production. • Diet preferences, demand for local or imported products and the fraction of food wasted play a significant role in water usage. • The infrastructure required to irrigate crops (including reservoirs), can reduce land available for food production. • Sea-level rise can have an impact on the delta regions, as sea water intrusion can have a negative impact on current food production systems. • Diverting water for irrigation can influence other food-producing sectors by altering the natural flow of rivers, having a negative impact on fisheries. • Water quality is an essential issue for food production.	• Water, as energy dissipating medium in the atmospheric circulation system, governs the global climate through evaporation, cloud formation, and precipitation. • Water forms landscapes which in turn shape a regional or local climate of their own. • Water management, alters regional or local climate patterns. • Water acts as a greenhouse gas. • Water vapor forms clouds and clouds reflect and scatter radiation. • Water distributes solar energy via evapotranspiration and condensation, thawing, freezing, and sublimation. • The process of evapotranspiration slows down where there is water shortage and most solar energy is then converted into sensible heat. • Drainage of wetlands and deforestation in favour of agricultural land should lead to less evapotranspiration and more sensible heat. • Due to the relatively high heat capacity, water bodies dampen temperature extremes in their vicinity. • Local climate optimization can be favored by water for minimizing temperatures extremes.
Energy	• Energy, commonly electricity, is needed for pumping (extraction and distribution). • Energy for water purification. • Energy for wastewater treatment. • Energy for non-conventional production of water. • Energy for the operation of pump storage power plants. • Energy for water heating. • Energy use at household level for other water uses (washers). • Energy used for irrigation/pumping in agriculture. • Implications to water quality from thermal power operation, hydropower generation, thermal power generation, hydropower production and storage. • Environmental flows' regulation, due to energy generation.		• The distribution of individuals within countries has traditionally been a product of people settling in locations where plentiful energy resources drive local economic activity. • Fossil fuel extraction, solar panels, and windmills for power generation, etc. involve direct impacts on land such as removal of vegetation, soil, and alters topography. • Fossil fuel extraction involves indirect impacts associated with pollutants/effluents. • The extraction/generation/production and transmission infrastructures associated with all energy technologies have implications for land use. • Various processes are needed to make an energy source feasible, i.e. rights of way for oil pipelines and the processing needed for biofuels and fossil fuels. • Many countries rely on imports of energy fuels, meaning that some implications of the land use are felt externally to the country that consumes the energy. • Land requirements at many stages of energy supply chains. • Landscape and land use, over time, has been shaped by the capture, conversion and use of energy and the opportunities this energy affords. • Renewable energy sources will replace the energy provided through fossil fuels and through the process of decarbonization, there will be more significant changes to land use. • Biofuels production will result in indirect land use change (ILUC), increasing the price of agricultural land which will induce the conversion of non-agricultural land that tends to be carbon-rich into relatively carbon-poor agricultural land. • Large hydro schemes, for both generation and storage, have the potential to alter land considerably both upstream and downstream. • For some technologies (such as nuclear) the footprint may include exclusion zones for the possibility of accidents as well as land requirements for spent fuel storage facilities.	• Current diet habits demand more processed goods and more meat/fish, resulting in greater energy requirements related to the transportation of food to factories and the energy use within factories to process the food. • Increasing productivity using fertilizers and pesticides, which require energy to be produced and as their use increases, so will be the energy required to produce them. • Pumping or desalinating water for irrigation purposes, lead to more energy intensive food products. • Biofuels take land from food for human consumption. • Energy is needed in agriculture and livestock sections and therefore for the production of corresponding goods. • Energy consumed in the fishery sector (including aquaculture). • Energy is needed in food transformation from agriculture, livestock and fishery. • Energy is needed throughout the supply chain of food products. (production, transportation, conservation).	• Massive fossil fuel combustion causes climate change. • All energy captured by human infrastructures finally dissipates as heat to the environment. • Energy production and consumption is concentrated in time and space, leading to the formation of hot spots, especially around larger cities (urban heat islands, UHI). • UHI affects the dominance of impervious surfaces and comparably sparse vegetation in urban areas, leading to lower evapotranspiration rates and upheating.. • The choices of the buildings' energy footprint affect the climate of the city. • All human activities related to energy are responsible for gasses emissions leading to the greenhouse effect and correspondingly to climate change.
Land Use	• Urban subsector is responsible for high water usage, sewage and waste disposal, increased runoff from developed areas and construction sites, and runoff from the volume of lawn fertilizers and pesticides. • Industrial subsector is a large water consumer, disposes industrial waste on surface and underground water resources and creates high runoff. • Agricultural subsector has enormous irrigation needs, is responsible for chemical and nutrient inputs from fertilizers, pesticides etc., and creates high runoff. • Forests effectively cycle water with very small losses to surface and groundwater, while evapotranspiration consumes a great part of water. • Wetlands act as a retention buffer for water, conserve water, moderate runoff, function as a natural purifier, reduce flood risks at downstream locations, and improve water quality.	• Artificial surfaces (urban and industrial) require a continuous supply of energy to support infrastructure, transport, buildings, water supply, food production and industrial-commercial activities. • The increasing demand for industrial land require even larger amounts of energy and reduces the availability of forest and energy crops as resources for the production of bioenergy. • Agriculture areas use energy as an input to production, but can also provide renewable fuel feedstock for the energy sector. • Forests and semi-natural areas provide resources that can be made available for use in the bioenergy sector for the production of both heat and electricity. • Wetlands can be source of energy peat. • Inland water bodies regulated by artificial dams allow for hydropower production in regions with sufficient water supply.		• Built-up areas, including urban and industry areas, have a food production role, where most food is consumed and small-scale (urban) agriculture takes place. • Pastures have a food production role as grazing ground for different animals, important for dairy farming. • Cropland has a food production role for direct human consumption and for feed. • Forests have a food production role as provider of non-timber products (e.g. bush meat, nuts, and seeds). • Wetlands have a food production role in aquaculture and freshwater fish, as well as (marginal) crop production.	• Urban land use affects microclimate of urban regions with the creation of heat islands. • Land use is important when it comes to absorbing solar radiation: Incoming solar radiation is absorbed by concrete and other building materials much more than vegetation, which partially reflects the incoming radiation and part of the absorbed energy is used for evaporation from leaves. • High buildings can modify the local wind regime, limiting the exchange of air masses with the peri-urban areas. • Heating and cooling of buildings increase air temperature. • Increased traffic in urban areas contributes to GHG emissions, affecting the climate. • Industrial activities directly affect the climate through GHG emissions, including CO_2. • Deforestation to create new agricultural land has consequences on the microclimate because of different energy budgets. • Agriculture also contributes to CO_2 sequestration, by absorbing CO_2 through specific crops and by reduced use of fertilizers, pesticides, mechanical work on soil. • Vegetation and forestry have a direct impact on the microclimate, by affecting the albedo, providing cooling and lowering the air temperature of the region. • Forestry affects the climate by absorbing CO2, thus reducing GHG emissions. • Large water bodies (e.g. oceans) are the main carbon sinks and buffer seasonal fluctuations because of the great heat storage of these water bodies. • Lakes affect the microclimate of the region, by altering the albedo, cooling the air temperature and by acting as carbon sinks.
Food	• Crop based food production needs irrigation through rainfall plus withdrawal of (ground-) water resources. • Animal based food production has direct water requirements for animal drinking and indirect through water required in plant-based production as animal feed. • Fish based food production requires freshwater in inland fisheries and aquaculture systems. • Agro-chemicals (crop protection products) will impact water quality. • Antibiotics and possibly hormones will have an impact water quality. • Fisheries and aquaculture can have an impact on algal biomass and chemical content of water, also affecting the (freshwater) biodiversity. • Food consumption has an additional impact through virtual water imports/exports. • Changing diets have an impact on the required water footprint. • Certain food products and its waste impact water quality.	• A large amount of energy put into food production is wasted, since the food is not consumed. • Unused food can go to composting facilities or anaerobic digesters to produce energy. • Anaerobic decomposition of food waste produces methane, which can be converted to electrical power or heat. • Another end product of anaerobic digestion of food waste is a residual digestate, that can be used as fertilizer. • Food processing waste that has high contents of oil and grease can produce biodiesel. • Food processing waste that has high contents of hydrocarbon can produce ethanol. • Food prices are intimately linked to global energy prices. • Biofuels can be produced from crops used for energy production (biocrops/biofuel/biodiesel).	• The growing demand for food, as well as non-food biomass, will lead to an expansion of global cropland. • Changes in meat consumed can result in a large pressure on land. • The impact that food production has on land use is strongly linked to the amount of food that is produced from a piece of land. • Food production can indirectly drive land degradation (erosion, soil compaction), by creating s higher demand that can be sustainably be produced in a certain region. • Food production includes the aspects of food waste and under/overconsumption, which will increase differences in ecological footprint of diets in different regions. • Footprints are not necessarily local to where the food is consumed, since a significant proportion of food produced around the globe is traded. • The impact that food will have on land use will depend on the agricultural/land use policies around the world.		• Livestock emissions (enteric fermentation, manure management). • Rice cultivation (methane emissions). • Soil management (N2O and C changes). • Burning of crop residues (carbon dioxide). • Fertilizer production and application. • Liming of agricultural soils (carbon dioxide). • Other emissions (e.g. machinery). • Food manufacturing, packaging, transport, home food related, retail, and catering (carbon dioxide). • Waste disposal (all emissions lost). • Refrigeration (refrigerant emissions). • Loss of climate regulation services of converted forests, peatlands and wetlands. • Change of surface albedo for agriculture and food-system related infrastructure. • Carbon dioxide emissions caused by burning of natural vegetation to clear land. • Possible changes to the hydrological cycle that can change the local climate.
Climate	• Global warming includes changes in seasonal patterns of precipitation and evapotranspiration and increased frequency and intensification of extreme events lead to general acceleration of the hydrological cycle. • The seasonal changes expected under progressing climate change will lead to alterations in precipitation and thus will affect water. • The increasing air temperatures will increase evaporation globally. • Climate change-driven river runoff changes broadly resemble the pattern of precipitation alterations. • Seasonal streamflow patterns of rivers depend on climate. • Floods and droughts are likely to become more frequent and severe, affecting the water regime. • Higher average air temperatures will inevitably lead to a rise in water temperature in all types of water bodies. • More frequent rain events will increase the load of suspended matter and nutrients to lakes and rivers. • Nutrient concentrations in lakes will likely rise, the risk of low-oxygen periods will increase and CO2 concentration will increase.	• Meteorological conditions directly govern the actual output of thermal solar panels, photovoltaics and wind turbines. • Hydropower installations and bioenergy plants depend on climate conditions via river discharge and biomass production. • Extreme temperatures lead to increased usage of heating and cooling systems. • Extreme weather situations leading to grid stability issues in the power sector can create blackouts. • Thermal power plants need cooling water to operate, the resources of which are affected by climate. • Climate change will lead to more air-conditioning in summer and less heating in winter; as heating is usually provided by fuel burning and while air conditioning is operated by electricity, the demand would shift towards electrical energy.	• Floods can affect all types of land use, i.e. urban, industrial, agriculture and forest. • Floods have strong impact on urban and industrial areas, where they can be devastating, causing economic losses (housing, infrastructure), health hazards and loss of human life. • Climate change intensifies the intensity and increases the frequency of flooding events, either as flash floods, or as floodplain/river flooding. • In coastal areas, the combination of high tides with river flooding can have even more devastating effects to urban and industrial environments. • Flooding affects agriculture, especially animal husbandry, by imposing severe economic losses. • Landslides are related to intense precipitation and can affect any type of land use, with the strongest and most devastating consequences in urban areas. • Landslides can also cause severe disruptions to the infrastructure (e.g. transport, roads). • Forest fires are a type of sudden, short duration, quick onset impact of climate to land use, which can cause extensive damage to urban and industrial areas. • Wind storms/Wind throws can cause severe damage to forest stands. • Hailstorms can cause damages to both agricultural and urban areas. • Increased frequency and intensity of heatwaves may affect urban land use, by decreasing the comfort index of the area and thus reducing tourism.	• Climate change is expected to bring about higher temperature, higher concentration of carbon dioxide in the atmosphere, and a different regional pattern of precipitation, affecting crop yields and agricultural productivity. • Pastoralism will be affected by climate change due to the feed inputs from agriculture and pasture being affected. • Heat stress affects milk production, poultry egg production and feed conversion. • Decreased water supply and increased water demand by livestock under climate change could also lead to lower production. • Projected increases in precipitation and heavy precipitation can bring difficulties in storing and managing manures. • Increased temperatures and risk of flooding facilitates the spread of diseases. • In the northern hemisphere, sea warming results in a shift to the north, and cooling causes to move species southwards. • Ocean acidification is projected to affect shellfish as at a low pH, growth and shell formation are impaired. • River and lake temperatures are expected to increase; this could impact the health and development of species, in addition to preventing migration.	

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Societal Implications of Nexus Interlinkages

INPUTS		OUTPUTS				
		Water	Energy	Land Use	Food	Climate
	Water		**Effect of Energy on society** • Hydro projects, possible impact on livelihoods and displacements. **Ensuing Research Questions** • How can water be used to create energy? • How could altering water land cover affect energy production?	**Effect of Land use on society** • Possible displacement for hydro projects. • Flooding means some areas could become less viable for farming/habitation or encourage new forms of farming. **Ensuing Research Questions** • How might future hydro power installations lead to displacements? • How could changes in the water cycle, including increased floods, or droughts affects agriculture?	**Effect of Food on society** • Food production dependent on water use. **Ensuing Research Questions** • How could changes in the water cycle and its use affect food production, prices and availability?	**Effect of Climate on society** • Water cycle and presence could affect rainfall through reservoirs or irrigation . **Ensuing Research Questions** • What impacts could changes in the water cycle have on climate?
	Energy	**Effect of Water on society** • Extraction for energy can reduce water security. • If demand for energy results in hydro projects, possible impact on livelihoods and displacements. **Ensuing Research Questions** • How can a balance be achieved between the competing demands of water energy and water?		**Effect of Land use on society** • If land given over for energy production: o Higher (localised) food prices. o Decline of food industry. o Possible urbanisation. o Cheaper energy supply? **Ensuing Research Questions** • How might energy policy affect land use? What knock-on effects would this have for society?	**Effect of Food on society** • N/A (but food affected through land-use change). **Ensuing Research Questions** • How can energy shocks on food be mitigated against?	**Effect of Climate on society** • Localised climate effects could be droughts/storms/floods with impacts on livelihoods and homes. • Use of second generation biofuels could bring cleaner energy. **Ensuing Research Questions** • How can extreme events impact society? • What steps can be taken to mitigate these impacts?
	Land Use	**Effect of Water on society** • Forest cover maintains regular water cycle. Degradation could lead to more floods/droughts. • Improved irrigation could help agriculture (but may happen at the expense of smaller farmers). **Ensuing Research Questions** • How might changes in land use affect the water cycle, including extreme events?	**Effect of Energy on society** • If land given over to biofuels, local food supply reduced. • Other forms of energy (wind farms, fracking) bring localised conflict. **Ensuing Research Questions** • How could changes in land use affect the price and availability of energy?		**Effect of Food on society** • Quantity and quality of land given over to food production will affect prices and livelihoods. **Ensuing Research Questions** • How could changes in land use affect food prices and livelihoods?	**Effect of Climate on society** • Water cycle and presence could affect rainfall through reservoirs or irrigation . **Ensuing Research Questions** • How might changes in land use impact on localised climate?
	Food	**Effect of Water on society** • Potential conflict between users of water. **Ensuing Research Questions** • How can the competing demands for water be balanced?	**Effect of Energy on society** • Farms can become more/less energy self-sufficient. **Ensuing Research Questions** • What could be the impact of using food residues for energy?	**Effect of Land use on society** • As food production becomes more or less efficient land use can change – impacts on livelihoods and migration. **Ensuing Research Questions** • To what extent will new land uses lead to urbanisation or ruralisation?		**Effect of Climate on society** • If intensive farming deemed as ruinous to the environment: -social pressures for "green" farming/diets. **Ensuing Research Questions** • How could policy limit the impact of intensive farming? • How could policy promote sustainable agriculture?
	Climate	**Effect of Water on society** • If climate change makes water more scarce: o High (localized) food prices. o Possible flood and droughts – displacements and urbanisation. **Ensuing Research Questions** • How can water use be made more equitable/optimised in the face of climate change? • How can risks of hazards be mitigated?	**Effect of Energy on society** • If climate change brings increase in sustainable energy: o Lower prices for consumers/exports. • If climate causes decrease in supply of energy: o Higher prices for consumers/imports. **Ensuing Research Questions** • How can energy use be made equitable/optimised in the face of climate change?	**Effect of Land use on society** • If climate causes change in quantity and quality of productive land: o New food production patterns. o Increased/decreased food security. o Impacts on availability and price of resources for farmers and others. o Changes in livelihood and adaptation (often for farmers and rural communities). o Potential for increased hazard risk and displacements. o Potential for conflict/social tension. **Ensuing Research Questions** • How can land use be more equitable/optimised in the face of climate change?	**Effect of Food on society** • If climate change lowers food production: o Higher (localised) food prices. o Decline/adaptation of food industry. o Possible urbanization. • If climate change increases food production: o Lower (localised) food prices. o Growth of food industry. o Possible rural migration. o Pressure for policy support. **Ensuing Research Questions** • How will livelihoods be affected and be made more resilient in the face of climate change? • How can policy prevent the need for, or support migration?	

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Economic implications of Nexus linkages

INPUTS \ OUTPUTS	Water	Energy	Land	Food	Climate
Water	Economic growth results in increased demand for water	Economic effects of water scarcity on energy • New hydro projects are not viable existing ones generate less, leading to energy scarcity / higher energy prices • Cooling water becomes more expensive • Fuel extraction and processing becomes more expensive • Biofuels become more expensive. • Investment in efficiency of water use for energy production	Economic effects of water scarcity on land • Arid areas become less viable for agriculture, which increases land prices • Irrigation becomes more expensive • Lower land productivity leads to higher costs for agriculture • Lower land productivity leads to indirect land-use change • Investment in water infrastructure, could lead to loss of land • Investment in innovation, precise irrigation	Economic effects of water scarcity on food • Lower productivity of land and fisheries leads to higher food prices. • Higher costs of agriculture passed on into food prices • Investment in water use efficiency, water infrastructure	Economic effects of water scarcity on climate • Direct and indirect land-use change due to crops migrating (e.g. changing rainfall patterns, river flows). • Deforestation to replace other degraded land • Investment in water management and irrigation infrastructure
Energy	Economic effects of energy scarcity on water • Higher levels of energy extraction and transformation increases water scarcity. • Waste water treatment and water purification becomes more expensive • Water heating becomes more expensive • Irrigation / water management becomes more expensive • Investment in energy efficiency of water use	Economic growth results in increased demand for energy	Economic effects of energy scarcity on land • Agriculture costs increase (fertilisers, fuels) • Higher energy prices lead to land-use change incl. deforestation, indirect land-use change, for biofuels production • Investment in more energy efficient farming technologies	Economic effects of energy scarcity on food • Food prices increase due to increased fertiliser and fuel prices • Investment in energy efficiency in food production	Economic effects of energy scarcity on climate • GHG emissions scale proportionally to fuel use (by fuel type), and fuel demand is determined by economic activity • Investment in energy efficiency in general reduces GHG emissions
Land	Economic effects of land scarcity on water • Lower productivity land becomes used, which often requires irrigation, increasing water scarcity • Deforestation occurs to expand land supply; forest cover controls the water cycle; deforestation changes water supplies • Investment in efficiency of land management (e.g. tractors)	Economic effects of land scarcity on energy • Competition for land between different forms of energy production (wind farms, fracking, biofuels) • Less biofuels can be produced • Lower productivity land becomes used, increasing production costs of biofuels • Investment in efficiency of land management	Economic growth results in increased demand for land	Economic effects of land scarcity on food • Food prices increase due to the use of lower productivity land and higher costs of production • Local food supply reduced. • The price of meat may increase more since it is more land-intensive • Investment in efficiency of land management	Economic effects of land scarcity on climate • Land scarcity leads to deforestation which emits large amounts of GHGs. • Direct and indirect land-use change leads to GHG emissions • Investment in efficiency of land management
Food	Economic effects of food scarcity on water • Expansion of food production (agriculture) leads to water scarcity through increased irrigation • Investment to reduce food waste	Economic effects of food scarcity on energy • Higher food prices reduce availability of food crops for biofuels production (ethanol, biodiesel) • Investment in efficiency of use of food crops for energy production (1st gen. biofuels)	Economic effects of food scarcity on land • Higher food prices lead to land-use change including deforestation, indirect land-use change	Economic growth results in increased demand for food	Economic effects of food scarcity on climate • Higher food prices incentivises direct and indirect land-use change, which leads to GHG emissions • Higher food prices leads to deforestation to increase the supply of land • Investment in efficiency of food systems
Climate	Economic effects of climate change on water • If climate change makes water more scarce: o Damages to existing water infrastructure o Investment in infrastructure for water management, water transport, access to groundwater. o Investment in new technologies for improved irrigation.	Economic effects of climate change on energy • If climate change brings increase in renewable energy resources (e.g. wind, river flows, cloud cover): o Lower prices for consumers/exports. • If climate causes decrease in supply of renewable energy resources: o Higher prices for consumers/imports.	Economic effects of climate change on land • Destruction of land assets (e.g. floods, landslides, desertification) • If climate change causes change in quantity and quality of productive land: o Increased/decreased land scarcity. o Increased/decreased agriculture outputs o Impacts on availability and cost of resources for farmers and others.	Economic effects of climate change on food • If climate change lowers food production: o Higher (localised) food prices. • If climate change increases food production: o Lower (localised) food prices. • Costs of losses of crops • Investment into R&D to fight plant diseases, yield collapse	

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Low-C options

Low-C options in domain of energy

- Solar energy and wind (Food/Land, Water)
- Hydropower (Land, Water)
- Biofuels (and biomass) (Land/Food, Water)
- Geothermal energy (Water)
- Nuclear energy (Land, Water)

Low-C options in agriculture, forestry and land use

- EC proposal to integrate GHG emissions from LULUCF into 2030 climate and energy framework
- Aims to incentivise more climate-friendly LU, climate-smart agriculture and climate-benefits of wood products (C sequestration).
- Technical Low-C options are presented.

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What's next?

- Task 1.2: Use cases for SIM4NEXUS (M18)
- Task 1.3: Review of Thematic Models in their capacity to address the Nexus and to cover relevant policy domains—Identifying Key Gaps (M12)
- Task 1.4: Multifaceted uncertainty analysis (M24)
- Task 1.5: SIM4NEXUS Framework for the Assessment of the Nexus in Case Studies (M18)
- Task 1.6: Innovations to improve the Nexus for Case Studies (M18)
- Task 1.7. Assessment of the performance of innovations / interventions via Nexus Performance Indicators (M48)

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WP2: Policy analysis of the WLEFC-nexus

Maria Witmer
Stefania Munaretto

PBL Netherlands Environmental Assessment Agency

30 May 2017

EAB, Prague

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Objectives of WP 2 'Policy analysis of the WLEFC-nexus'

- Identify and review critical policy areas relevant to the WLEFC-nexus across scales, near- and long term.
- Analyse interactions, coherence, conflicts between policies, 'nexus compliance'.
- Recommendations, especially removal of implementation barriers.
- Strategies for a resource-efficient and low-carbon Europe.
- Windows of opportunity to influence EU policy-making.
- Feed the serious game with policy options.

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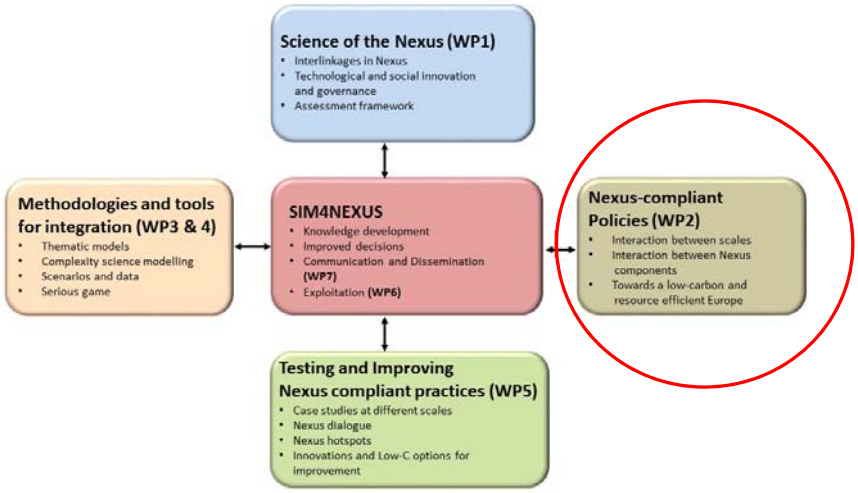
WP2 in SIM4NEXUS project structure



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Tasks of WP 2

- T2.1 Identification of policy areas and coherence analysis of policies at European and related global scale, '**top-down**'. Build a policy documents database. *May 2017*.
- T2.2 Identify policies at national, regional and transboundary regional scale in the cases. Coherence and conflicts in implementation, '**bottom-up**'.
  Milestone November 2017, July 2018.
- T2.3 Success stories, key factors. *November 2018*
- T2.4 Summarize findings so far. *May 2019*.
- T2.5 Recommendations for improving policies and policy making, strategies for resource-efficient and low-carbon Europe. *May 2020.*

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WP2 output of first year

- T2.1 Identified policy areas and coherence analysis of policies at European and related global scale, 'top-down'. Built a database of EU and global policy documents.
- T2.2 Common method for regional and national policy analyses, made a guidance, gave instructions, applied to pilot Sardinia.
- COMMON DEFINITIONS AND MUTUAL UNDERSTANDING

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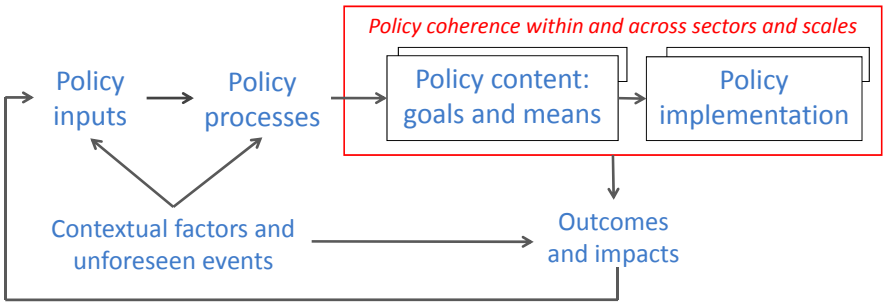
Policy coherence in SIM4NEXUS



Policy inputs – knowledge, resources, actors that feed into policy-making
Policy processes – procedures and institutional arrangements that shape policy-making
Policy content – goals and instruments chosen for a specific course of actions
Policy implementation – arrangements set in place by gov.t and others to put policy instruments into action
Outcomes – short-mid-term behavioral changes/responses of actors as reaction to implemented policies
Impacts/output – environmental and other effects resulting from the outcomes in the long term

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Two main approaches in policy analysis

- **Substantive >** it is about *content* > **goals** and **means**
- **Procedural** > It is about policy-making *process*: policy cycle > agenda-setting, policy formulation, decision-making, implementation, evaluation

Policy coherence is an attribute of policy referring to the systematic effort to reduce conflicts and promote synergies within and across individual policy areas at different administrative/spatial scales

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Identified relevant policy domains within and outside WLEFC-nexus

- The definition of the WLEFC-nexus is context specific and so are the relevant policies.
- Policies that consciously aim at influencing water, land, energy, food and climate: ecological, spatial, production & consumption and broader socio-economic viewpoint.
- Policies outside WLEFC domains, especially in context resource-efficient and low-carbon economy in Europe: economy, investment, R&D and innovation, ecosystems and environment, regions, development, risk & vulnerability, trade. Other policies, depending on the issues at stake, e.g. policies for sectors that have a key role in the cases.

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Method for policy analysis

- Collecting primary and secondary documents
- Mapping policy goals, objectives and means
- Selecting policy objectives to include in the assessment of interactions
- Assessing bilateral interactions between objectives in the WLEFC-nexus at EU level
- Selecting NCOs; further investigation:
  - Horizontal external coherence of objectives
  - Horizontal external coherence of means
  - Level of integration of synergies and conflicts in policy documents (*0=no integration; 1=little; 2=moderate; 3=strong*)
  - Vertical coherence between global objectives and EU WLEFC objectives

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Analysed policy documents and built database of 131 EU and international docs

Joint effort

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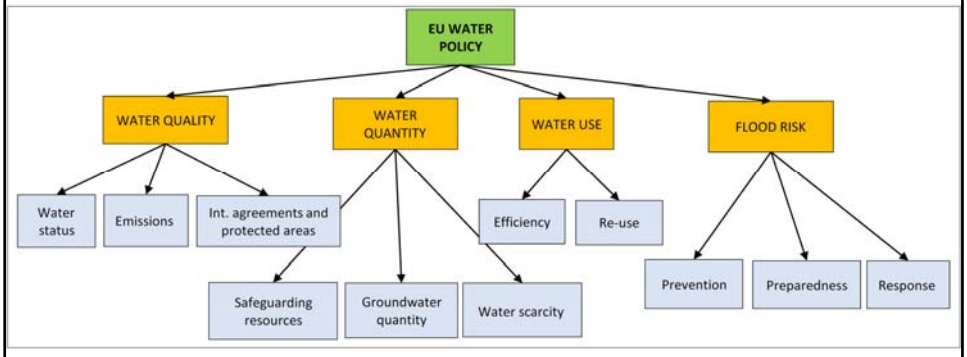
Basis for policy schemes & tables, selection of objectives, coherence analysis



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Selected objectives

- Relevance of the objectives to the project
- Potential of the objectives to have a high number of interactions
- Unambiguous and clear definition
- 33 objectives across 5 WLEFC policy sectors

EU WATER POLICY	
W1	Achieve good water quality status
W2	Ensure sufficient supply of good quality surface water and groundwater for people's needs, the economy and the environment
W3	Increase water efficiency
W4	Reduce water consumption
W5	Assess and manage flood risk and mitigate flood effects
W6	Address and mitigate water scarcity and drought
EU ENERGY POLICY	
E1	Increase production of biofuel
E2	Increase consumption of biofuel
E3	Increase production of energy from biomass (excluding biofuel)
E4	Increase consumption of energy from biomass (excluding biofuel)
E5	Increase hydro-energy production
E6	Increase hydro-energy consumption
E7	Increase energy efficiency
E8	Reduce energy consumption
E9	Push forward important energy infrastructure projects (grid, network, interconnectors, etc.)
E10	Achieve energy supply security
EU LAND USE POLICY	
L1	Restoring degraded soils to a level of functionality consistent with at least current and intended use
L2	Prevent soil degradation
L3	Maintain and enhance forest cover
L4	Prevent indirect land use change from nature to productive use
EU FOOD AND AGRICULTURE POLICY	
F1	Contribute to farm incomes (if farmers respect rules on environment, land management, soil protection, water management, food safety, animal health and welfare - 'cross-compliance')
F2	Improve competitiveness of agricultural sector (including sector-specific support and international trade issues)
F3	Ensure provision of environmental public goods in the agriculture sector
F4	Support rural areas economy (employment, social fabric, local markets, diverse farming systems)
F5	Promote resource efficiency in the agriculture, food and forestry sectors
F6	Reduce and prevent food waste
F7	Reduce intake of animal protein in human diet (non-binding objective; expressed intention on a research phase)
EU CLIMATE POLICY	
C1	Reduce GHGs emissions to keep global temperature increase within 2 degrees
C2	Increase efficiency of the transport system
C3	Support the development and uptake of low-carbon technology
C4	Support the development and uptake of safe CCS technology
C5	Incentivize more climate-friendly land use
C6	Promote adaptation in key vulnerable EU sectors and in MSs

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Coherence analysis
Typology of bilateral interactions (Nilsson et al., 2016)

Cancelling	Progress in one objective ***makes it impossible*** to reach another objective and possibly leads to a deteriorating state of the second. A choice has to be made between the two
Counteracting	The pursuit of one objective ***counteract*** another objective
Constraining	The pursuit of one objective ***sets a condition or a constraint*** one the achievement of another objective
Consistent	There is ***no significant interaction*** between two objectives
Enabling	The pursuit of one objective ***enables*** the achievement of another objective
Reinforcing	One objective ***directly creates conditions*** that lead to the achievement of another objective
Indivisible	One objective is ***inextricably linked*** to the achievement of another objective

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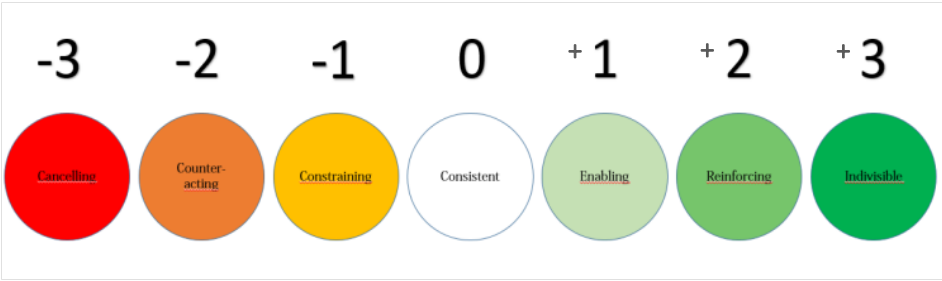
System for scoring bilateral interactions



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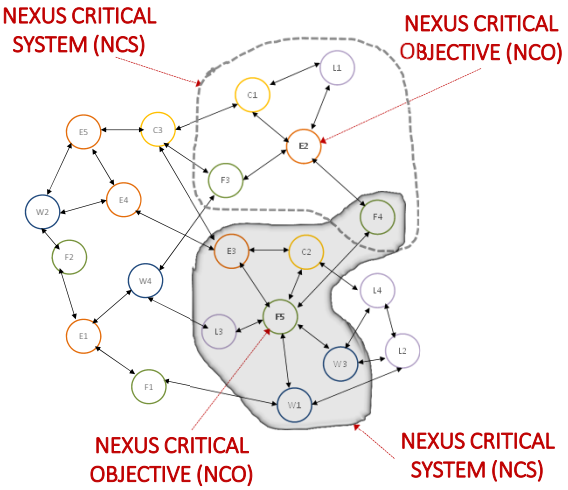
Density of interactions: nexus criticalities/hotspots



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Scoring approach

- Scoring process:
  - Individual scoring by two researchers
  - Comparison of individual scoring
  - Discussion of the most controversial interactions in a team of researchers
- Scoring criteria:
  - *What happens to objective X if we make progress on objective Y?*
  - Only direct interactions
  - Specification of the context
  - Justification of scores for the most controversial interactions
- Sources of information:
  - Expert knowledge
  - Evidence of policy interactions available in the literature
  - Information on bio-physical and socio-economic interactions provided by SIM4NEXUS WP1

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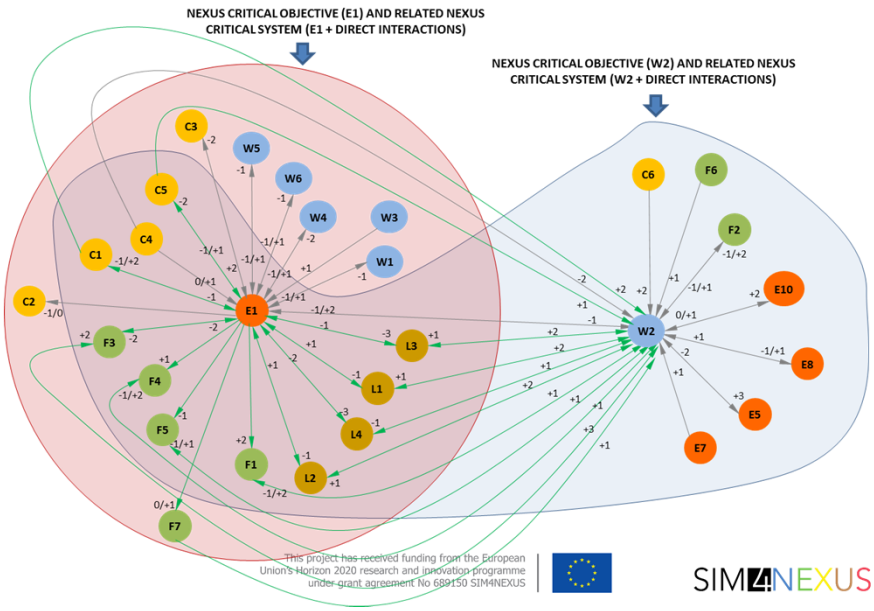
Screening matrix

What happens to objective x → (affected)
If we make progress on objective y ↓(affecting)

	W1	W2	W3	W4	W5	W6	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	L1	L2	L3	L4	F1	F2	F3	F4	F5	F6	F7	C1	C2	C3	C4	C5	C6
W1		+2		-1/0	+1	+1	-1/+1				-1/+1						+1	+1	+1		-1/+1	-1/+1	+2	-1/+2									
W2	+2		-1	-1		+3	-1/+2				+3			-1/+1		+2	+1	+1	+1	-1	-1/+2	-1/+2	+2	-1/+2	-1/+1								+1
W3				+3		+2	+1						-1/+1	-1/+1							+1	+2		+3									+3
W4	+1	+3	+2			+2	-1/+1				-1/+1		-1/+1	+2			+1	+1			-1/+1	-1/+1	+1		+2								+1
W5	-1/+1	-1/+1				0/+1	-1/+1									+2	+1	+1	+1		+1	+1	+1	+1								0/+1	+3
W6	+1	+3	+2	+3			-1/+1				+1			-1/+1		+2	+1	+1	+1		+1	+1	+3	+1	+1							0/+1	+3
E1	-1	-1		-2	-1	-1		+3								+1	-1	-1	-3	-3	+2		-2	+1	-1			-1/+2	-1/0	-2		-2	
E2							+3																					-1/+2	-1	-1			
E3																+1	-1/0	-1/0	-1/0		+1	+1	-1/+1	+1	+1	+1	-1/0		+2		-2			
E4									+3																			+2		-1			
E5	-3	-2		-1		-2/+2						+3			+1	+1			-1									+2		-1		-1	+1
E6											+3																	+2		-1			
E7		+1	0/+2	0/+2			-1/0	-1/0	-1/0	-1/0	-1/0	-1/0		+3		+1					+2	+2		+1	+3			+3	+1	+3			
E8	+1	+1		+2			-1	-1	-1	-1	-1	-1	+3		-1	+1					+2	+2			+3			+3	+1	+2			
E9											+1	+1	-1	-1		+2								0/+1	+2			-1/+1					
E10		0/+1					-1		-1		-1		-1	-1	+1						0/+1	0/+1		0/+2	-2			-1	-1				
L1	+3	+2			+2	+2	+1		+1										+2	+1	+1	+1	+2	+1	+2			+2				+2	+2
L2	+3	+2			+2	+2	+1		+1										+1	+2	+1	+1	+2	+1	+2			+2				+2	+2
L3	+1	+2			+1	+2	+1		+1		-1/+1						+1	+1		-1/+2			+1	+1				+3				+3	+2
L4	+1	+1		0/+1	+1	+1	-2		+1		+1		0/+1	0/+1			+1	+2	+3		-1	-1	+2	-1/+1				+2		+1		+1	
F1	+1	+1	+1	+1	+1	+1							-1/0	-1/0			+2	+2	+2	+2		-1/+1	+1	+1	-1/+1			+1		0/+1		+1	+1
F2	-1/+1	-1/+1	-1/+1	-1/+1		-1/+1							+1	-1/+1			-1	-1	-1/0	-1/0	+2		-1	+1	+2			-1		+1		-1	-1
F3	+3	+3			+1	+2			-2		-1/0				-1/0		+3	+3	+2	+2	-1/+1	-1/+1		+1				+1				+2	+2
F4	-1/+1	+1	+1	+1	+1	+1							+1	-1/+1			0/+1	+1	+1	+1	+1	+1	+1		+1							+1	+1
F5		+1	+3	+2		0/+1							+3	+3		+1		+1		+1	+1	+1	+1	+1		+1		+3	0/+1	+3		+1	0/+1
F6	+1	+1		+2		+1								+2		1			+1	+1	1		-1	+2				+2				+1	+1
F7	+1	+1		+2		+1								+2			+1	+1	+2	-2/+1	-2	-1/+1	-1	+2	+1			+3				+1	
C1	+2	+2		+2	+2	+2	-1		-1		+1			+1		+1	+2	+2	+1		-1/+1	-1/+1	+1	+1	+1	+1			+3	+3	+3	+3	
C2								-1						+3	+3	+2					+1	+1		+1	+3			+3		+2			
C3			-1/+1	-1/+1			+2	+2	+2	+2	+2			+3	+2						+1	+2			+3			+3	+3		+3		
C4	-2	-2		-1			0/+1		0/+1					-2														+3		+3			
C5	+1	+1		+1	+1	+2	-1/+1		0/+1								+1	+1	+1	-1/+1	-1/+1	-1/+1	+3	+1	+1			+3					+1
C6	+1	+2	-1/+1	-1/+1	+3	+3			0/+1		+1					+3	+1	+1	+2	+1	+2	+2	+2	+1	0/+1								

WLEFC-nexus critical objectives (hotspots)



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Level of integration of E1 and W2 in EU policy documents

E1 affecting WLEFC-nexus

Reference in renewables (E1) policy documents to …	
Water	2-3
Land	3
Food and Agriculture	2-3
Climate	3

W2 affected by WLEFC-nexus

Reference to W2 in policy documents of…	
Land	1-2
Energy	2-3
Food and Agriculture	3
Climate	1-2

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Vertical coherence E1 with global policies

- EU policies for biofuels generally coherent with global policies
- Food security and food prices are a central issue in global food policies and SDGs, but effects on them caused by the increase of biofuel production are weakly addressed in EU policies

- Water footprints of mitigation alternatives, mentioned by UNEP, not in UNFCCC and EU
- Social impacts of E1 on competition for land, water and other natural resources in developing countries is not mentioned in EU renewable policy. This is incoherent with targets 1.4 and 2.3 of the SDGs

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Conclusion

- More synergies than conflicts within WLEFC-nexus: at least on paper, there is coherence.
- Several objectives have high density of positive interactions > if pursued with integrated policies could have a cascade of positive effects, e.g. water supply

- Some WLEFC objectives can negatively affect other WLEFC objectives > choices have to be made

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Conclusion

- EU policy docs account differently for synergies and conflicts in the WLEFC-nexus.
- EU policies for biofuels are generally coherent with global policies. Food security and food prices connected to poverty are an exception
- EU water policies coherent with global policies. Relevant?
  EU food consumption & production < > global water.

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What's next?

- Discuss scoring and results with stakeholders: EU officers, NGOs and business representatives in the nexus
- Assess coherence in case studies: how synergies are exploited and conflicts addressed in implementation practices?
- Dissemination: windows of opportunity in several policy reviews by 2020 > EU energy package, WFD, CAP, EU strategy on adaptation, EU structural and development funds and the EU LIFE Programme

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Topics to discuss

- Feedback on methods used
- Advice on people to interview, Europe, Global
- Advice on windows of opportunity for dissemination
- Reflect on incorporation of results from policy analysis into thematic models, complexity models, serious game

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System dynamics modelling and the Serious Game

EAB Meeting

Dr Lydia Vamvakeridou-Lyroudia (UNEXE)
Xavier Domingo & Francesc Guitart (EURECAT)

30/05/2017

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Outline

- SIM4NEXUS/ Conceptual structure
- WP3/WP4 in short
- About System Dynamics Modelling and its role in SIM4NEXUS
- The Serious Game concept
- Fast track (Sardinia) and next steps (Greece and beyond)
- Challenges and Discussion

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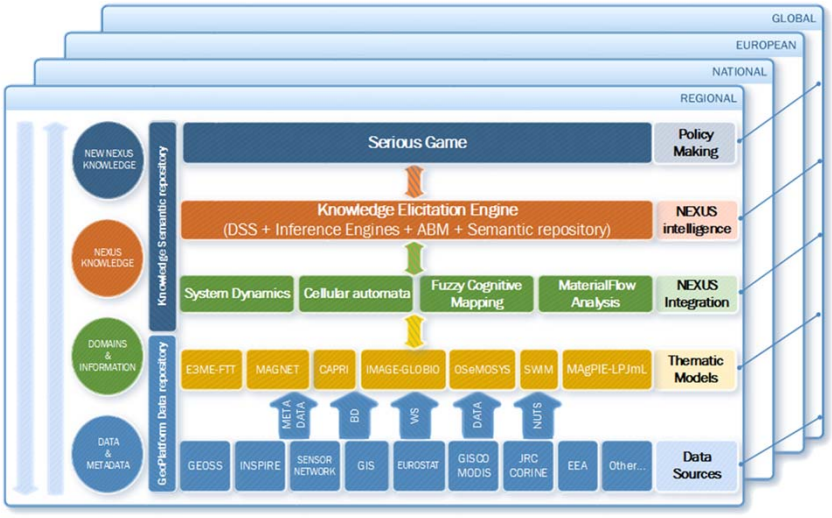
Conceptual structure



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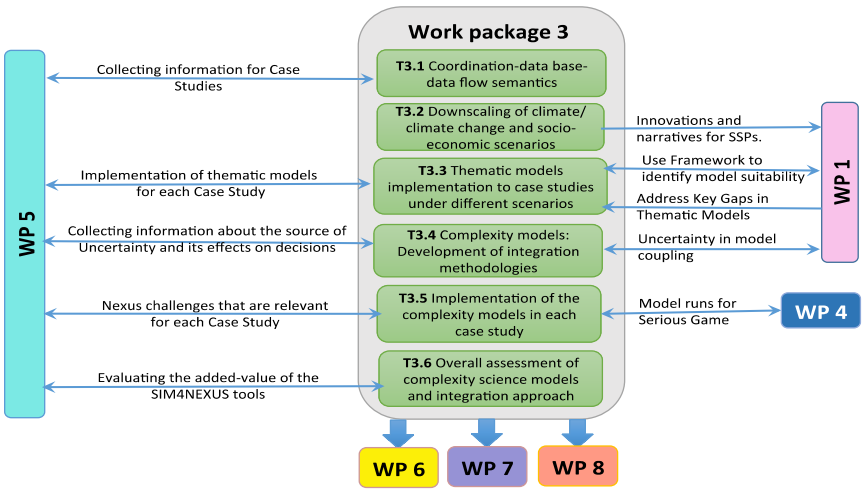
WP3-Thematic Models and Integration: Complexity Science modelling

Leader: UNEXE
Co-Leader: UPM



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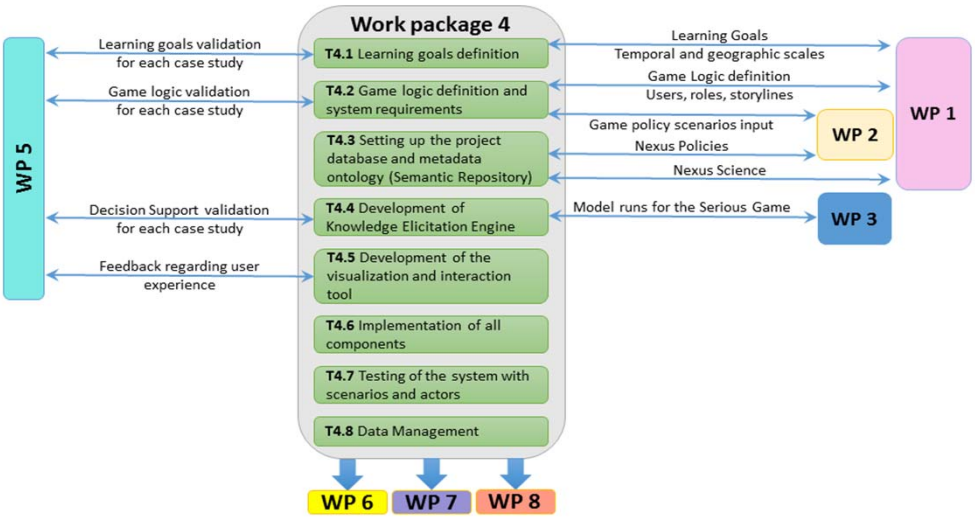
WP4-Serious Game development and testing

Leader: EURECAT
Co-Leader: EPSILON



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System Dynamics Modelling

System Dynamics Modelling (SDM) or Systems Thinking

- **Methodology for analyzing, studying and managing Complex Systems**
- **When formal analytical methods do not exist (or are hard to apply)-**
- **By linking feedback mechanisms (loops and iterations)**
- **Breaking down the problem into sub-systems and sub-models**
- **In a way similar to the conceptual thinking of non-programmers (conceptual models)**
- ***Visualisation using specialised software (interface)-platform (here: STELLA and VENSIM)***
- ***Models built gradually starting with few components, adding complexity interactively***
- ***Easy to implement "changes"***
- ***Different time scales for different subsystems***

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System Dynamics Modelling

Suitable for developing a model in participatory process

→ very important for SIM4NEXUS (Experts WP3-WP4-WP2-WP5/Case Studies/Stakeholders)

Acting as *Decision Support Tools (DST)* for stakeholders (non-engineers) and experts for examining alternatives/scenarios

SDM for business models (initial use), environmental sciences, ecology…..

Innovative/contemporary use

- ***SDM suitable as integration methodology in complexity science (various types)***
- ***E.g. valuation of ecosystem services, circular economy…***
- ***Combined (complementary) use with other methodologies (Cellular Automata…)***

- ***→ SIM4NEXUS: Using SDM as a feeder for Serious Gaming***

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SDM model development in SIM4NEXUS

For each case study separately

The case study team:

- **Prepares the Conceptual model (with help/guidance from the project SDM team)**
- **Collects the numerical data needed from the thematic models and other sources for three scenarios : 2010, 2030 and 2050.**

The project SDM team

- **Builds a computer simulation model (SDM- Quantitative model- in STELLA environment)**
- **Tests the model**
- **Transfers the model to R (for feeding the Serious Game engine) (← *innovative approach*)**

Both the SDM and the Case Study teams

- **Use the model to produce and assess alternative policies/scenarios**
- **With interactive process, improving the model by iterations, between the conceptual and the quantitative (until satisfied…) (Validation)**

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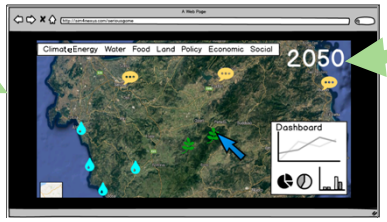
The Serious Game concept

Settings

GeoPlatform, gathering all metadata

Case studies

The virtual world is designed according to realistic metadata



The game involves players, acting according to chosen roles

Each player manages own **objectives** and **indicators**, and can only take **specific actions (applying policies)** according to the role assigned

Try out scenarios

With local stakeholders: 3 at regional level, 5 at national level, 2 transboundary

At higher level (educational): 1 at European level, 1 at Global level

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Description of a scenario

Uncertainty, like financial crisis, flood, temperature changes, etc.

All Nexus components interacting together.

Water, land, energy, food, climate

SDM (R version –WP3) through KEE (WP4)

calculating interlinkages between each Nexus component

LEARNING BY PLAYING

Actions (policies) by players

Evaluation by players

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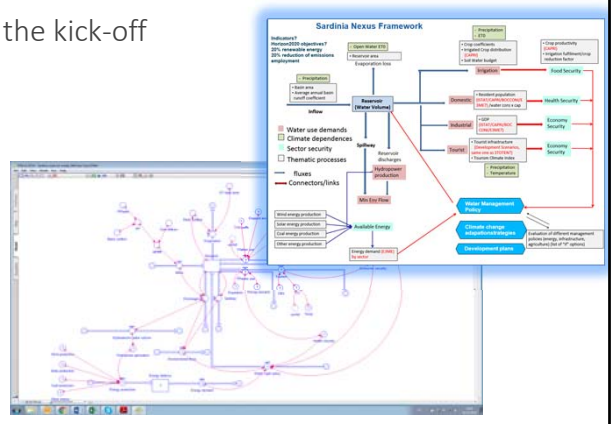
The first CS: Fast track Sardinia (WP3/WP4)

- Sardinia: "Fast track" to try out the methodological approach from end to end
- Not included in the GA – decided during the kick-off
- M12/May 2017
- Conceptual ✓
- Thematic models ✓
- SDM ✓
- Transfer to R-feed to WP4 ✓
- Data MGT for WP4 (under way…)
- Policies for the SG (under way…)
- SG/Visuals (under way…)
- Next CS (Greece: Conceptual ✓, Thematic models ✓)



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SDM/Serious Game Challenges

- **Setting up the structure of the conceptual models for each Case Study – preferably the same structure for 2010, 2030 and 2050**
- **Data (a) from the thematic models (b) from other sources (WP3/WP4)**
- **R script (WP3 team)**
- **Data transfer/management (WP3/WP4)**
- **Representing/modelling the policies in the SDM model (currently under discussion WP3/WP4 with WP2-first "specific" approach from Sardinia… →)**
- **Ultimately: Graphics for the Serious Game (WP4, but also a challenge across WPs, e.g. WP5)**

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Policies for Sardinia (from the local stakeholders-May 2017)

1. Impact of potentially bringing methane to the island (reduce costs for energy, lower CO2 emissions per Kwh) produced.
2. Implementing water pricing policies:
   - infrastructure that would allow the water managing authority to become nearly self sufficient for energy: this would reduce the costs of water for the agricultural sector by about 60/70 %
   - policies at the moment are chaotic and many ask for a clear regulation/suggestions
3. Investigate the impact of biomass production for the island
   - increase the share of forest biomasses and agricultural residues for energy production and investigate impact
   - control the use of land for biomass production (maize) which absorb lots of water and takes land from food production
4. Suggest (stricter) rules for minimum environmental flows from dams

Challenges-potential "practical use" in the area (where S4N may help)

1. *Exchange of information between water consumers (farmers) and water managing authority: the inaccuracy of information really complicates their planning*
2. *Rural development and resources allocation planL currently unclear, ambiguous and only few can manage to use the allocated resources, not coherent with any objectives.*

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WP 3: Thematic models

WP5 : Implementing Nexus compliant practices (Case studies)

EAB Meeting

Maria Blanco & Maïté Fournier

UPM & ACTeon

31 May 2017

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WP3 (Thematic models) – Objectives

- Leader UPM; Involved partners: WUR-LEI, UNEXE, KTH, PIK, CE, RU, PBL
- Main objective: **application of the thematic models**
  - to support Nexus-compliant decision making (in close interaction with Task 5.2)
  - as an input for the development of complexity models in Task 3.4

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WP3 (Thematic models) – T3.3

- Activities:
  - **Selection** and adaptation of the suitable thematic models for each simulation scenario and case study *(M3-M9)*
  - **Preliminary run** of the thematic models in order to identify the gaps in the Nexus for the case studies (based on general requests from WP5) *(M4-M12)*
  - **Full implementation** of the thematic models for each case study for specific scenarios (implied by WP5 and WP2) *(M13-M24)*
  - **Additional unforeseen applications** of the thematic models after the initial development of the complexity models (when required by WP5 or by T3.4 or 3.5) *(M25-M45)*

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Thematic models

	E3ME-FTT	MAGNET	CAPRI	IMAGE-GLOBIO	OSEMOSYS	SWIM	MAgPIE-LPJmL
Nexus components	Energy, land, economy, climate	Food, land, economy, energy, climate	Food, water, env., bioenergy, climate	Land, env., water, energy	Energy, land, climate, water	Water, land, climate	Food, land, water, env., bioenergy, climate
Geo coverage	Global	Global	Global	Global	Global	River basins	Global
Spatial EU resolution	National	National	Regional (NUTS2)	Detailed grids	River basin, national	Regional, river basin	Detailed grids
Appl. to case studies	Global, EU-wide and national	Global, EU-wide and national	All	Global and European	Global and national	Transboundary	Global and European
Time step	Annual	Flexible, until 2050	Flexible, until 2050	Annual	Annual	Annual	5-year steps
Time frame	Until 2050	Until 2050	Until 2050	Until 2100	Until 2050	Until 2050	Until 2100

4

T3.3 Deliverables

Deliverables	Month
D3.1 – Report on the "first run" simulation results of the thematic models: Identifying the gaps	✓ 12
D3.3 – Final report on the application of thematic models	45

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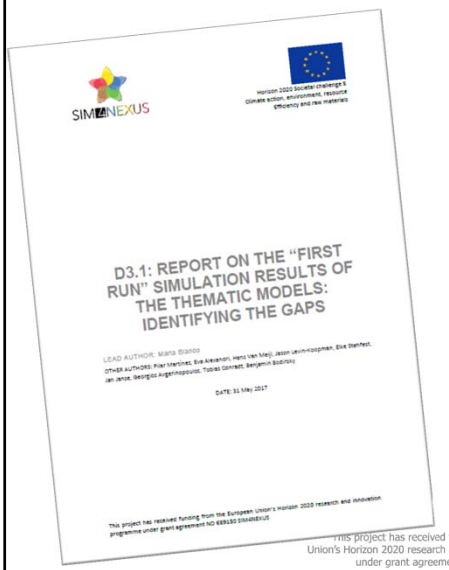
WP3 Deliverable 3.1



Published : May 2017

Common baseline scenario for all thematic models

Coordination with WP5

Contribution to fast track case study

Fact sheets for all thematic models

Preliminary baseline results (global level)

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WP5 coordination & objectives

- Lead by Floor Brouwer (WUR-LEI), Maïté Fournier (ACT)
- Apply the methods of integration and tools of integrating the Nexus components, addressing real-life challenges in 12 selected case studies
- Establish a science-policy participatory process, guiding end-users towards Nexus-compliant practices that support a resource-efficient Europe

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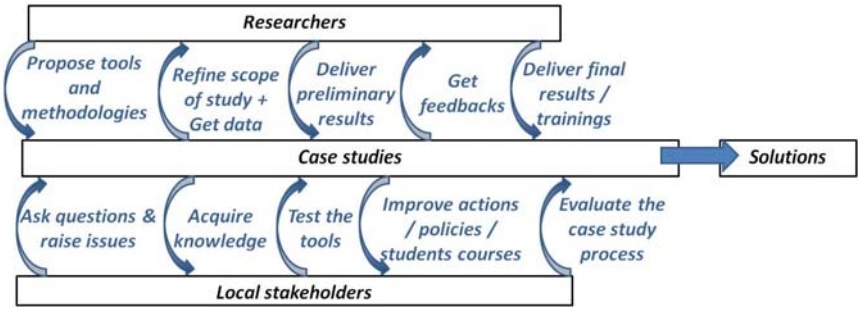
WP5 science-policy participatory process



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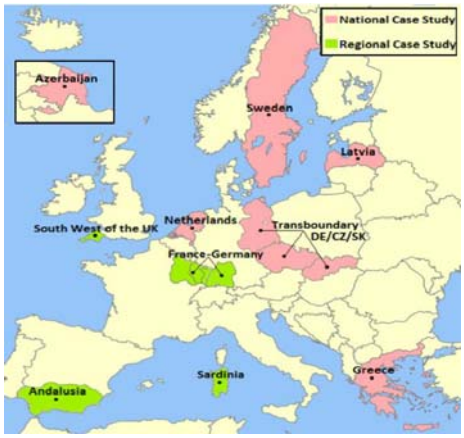
WP5 case studies

- 12 case studies representing a diversity of scales for decision-making, as well as socio-economic and institutional conditions
- Participatory processes that closely associate relevant stakeholders & end-users of SIM4nexus products



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Use of thematic models in the case studies

	E3ME	MAGNET	CAPRI	IMAGE-GLOBIO	OSEMOSYS	SWIM	MAGPIE-LPJML
ANDALUSIA	XX	XX	XX				
SARDINIA	XX		XX	XX			
SOUTHWEST UK	XX		XX				
THE NETHERLANDS	XX	XX	XX				
SWEDEN	XX	XX	XX	XX			
GREECE	XX	XX	XX	XX	XX		
LATVIA	XX	XX	XX				
AZERBAIJAN	XX	XX	XX		XX		
FRANCE-GERMANY	XX		XX			XX	XX
GERMANY-CZECH REPUBLIC-SLOVAKIA			XX			XX	
EUROPE	XX	XX	XX	XX			XX
GLOBAL	XX	XX	XX	XX	XX		XX

WP5 Tasks

- T5.1 – Developing a common application & evalutation framework for SIM4NEXUS tools
  Lead: ACT (M2 – M5; July – October 2016)
- T5.2 - Supporting decision making in 12 case studies
  Lead: WUR-LEI (M6 – M42)
- T5.3 – From case study applications to EU-wide recommendations
  Lead: UNEXE (M37 – M48)

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WP5 deliverables

Deliverables	Month
D5.1 – Common application & evaluation framework	✓ 05
D5.2 – The main Nexus challenges in 12 case studies	15
D5.3 – Using the modelling approaches in 12 case studies	36
D5.4 – Workshop for sharing/confronting results from all case studies	40
D5.5 – Twelve reports presenting the outcomes of Task 5.2	42
D5.6 – Summary of the policy recommendations from all case studies	42
D5.7 – Report on the application of the Serious Game for education	42
D5.8 – Report on the application of the Serious Game for civil society	46
D5.9 – Guidance on the application of the Serious Game in participatory processes	48
D5.10 – Outcome of the European workshop	48

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WP5 deliverable 1

Published : November 2016

Global framework for all case studies

- intermediate milestones

Coordination with all WPs' tasks

Coordination of all case studies

Monitoring & Evaluation

Flexibility and specific cases

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Advice from EAB: Recommendations on WP5

- Global and European case studies
- Transboundary case studies
- Defining a case study 'success'

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WP6 DESCRIPTION
EXPLOITATION IMPACT AND SIM4NEXUS BUSINESS PLAN

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WP6 overview

- **Task 6.1 Market assessment (SI)**

  MS6 & MS7 Intermediate reports (outputs and market) M12

  D62: Final market study M48

- *Task 6.2 Ecosystem set-up and animation (SI)*

  D6.5: Ecosystem Support Group activity report M48

- **Task 6.3 Commercial products & services and exploitation strategies (SI)**

  MS16 Intermediate assessment of competition M18

  MS23 Product / service definition and exploitation strategy M28

  D6.1 / D6.3: Draft / Final exploitation strategy M30 / M48

- **Task 6.4 Creation of the project spinoffs (SI)**

  MS27 Go/No Go decision for the spinoffs M36

  D6.4: Business plan for SIM4NEXUS spinoffs M48

- **Task 6.5 SIM4NEXUS Legacy (ACTEON)**

  D6.6 SIM4NEXUS Legacy report M48

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Activity since kickoff (M1-M12)

- June – September 2016: Exploring SIM4NEXUS outputs and applications
- September – October 2016: Prepare a pitch and the survey
- November 2016 – April 2017: Survey
  - 284 individual contacts / 19.5% interaction rate / 24 interviews
- September 2016 – April 2017: Study the markets for consulting and serious games

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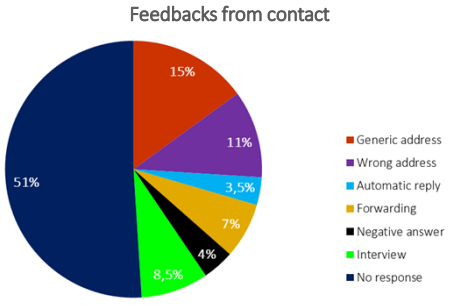
Survey – Initial outcomes

- 284 contacts from 135 organisations
  - Find relevant organisations
  - Find relevant contacts (by job position)
  - Find contact details
  - Contact
  - Re-contact many times…
- 19.5% interaction rate
  - Negative answer = 4%
  - Forward = 7%
  - Interview = 8.5% (24 interviews) → *Continue the survey to get representative results*



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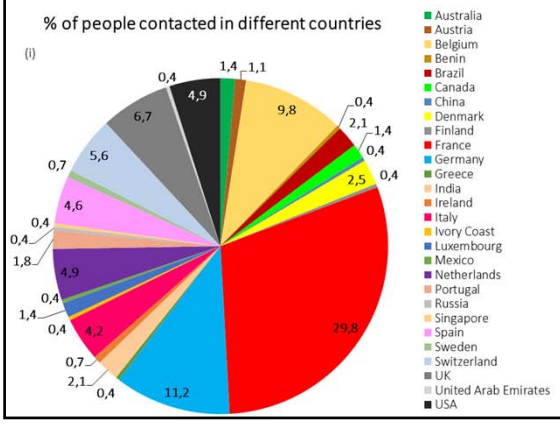
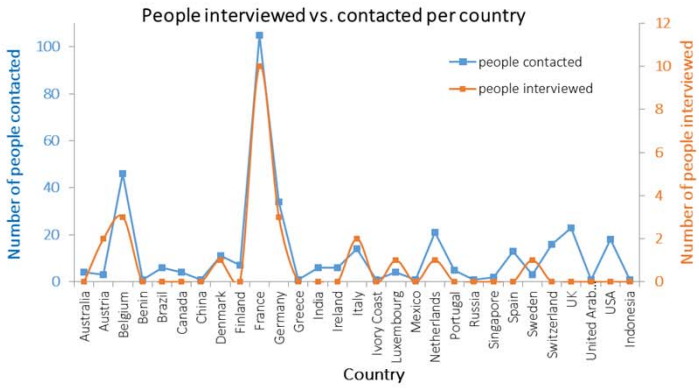
Survey – Intermediate outcome

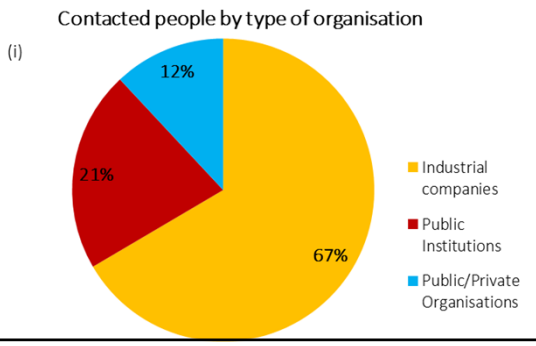
- Survey worldwide
  - France used as test bed, especially for industrial companies – To be replicated
  - Non-EU countries uninterested to interact with a EU project





Survey – Intermediate outcome

- Focus on exploring the market of industrial companies
  - SIM4NEXUS relatively mature for public administration
    - Response rate 3x industry / Interest more positive
  - Maturity limited for industry → More difficult to interact



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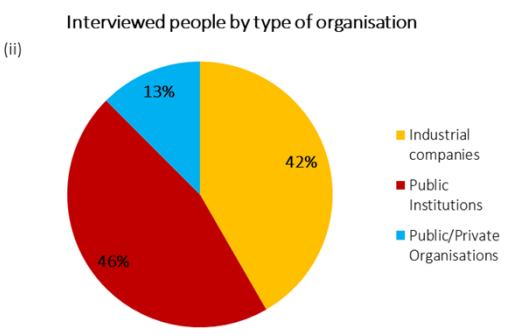
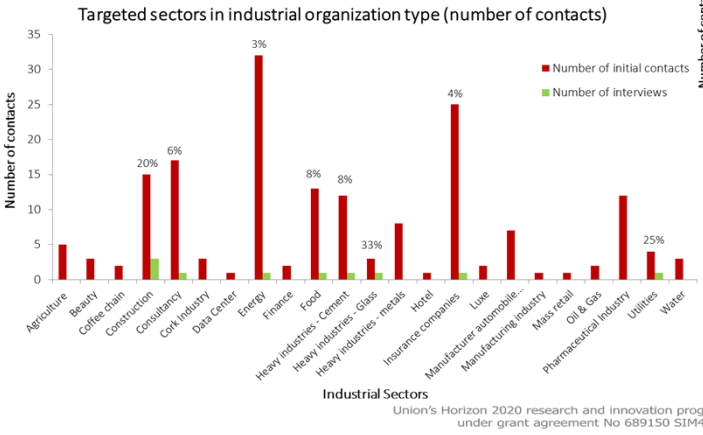
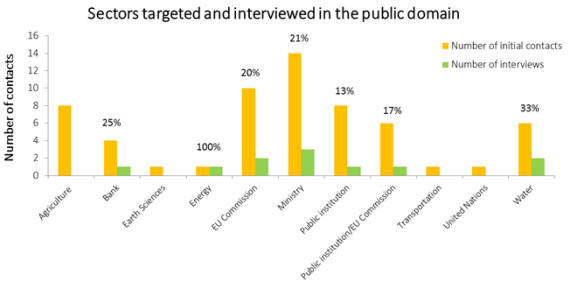
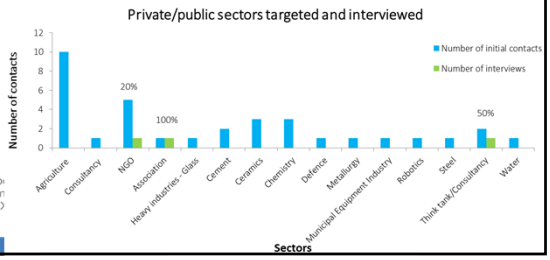


Survey – Intermediate results

- Large variety of sectors / profiles concerned







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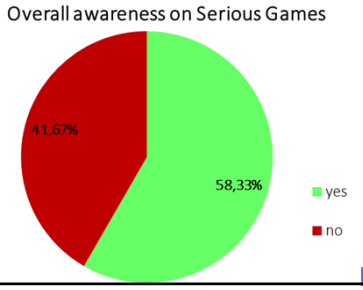
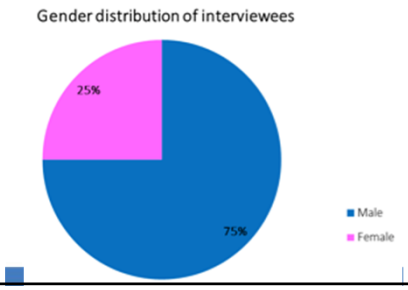
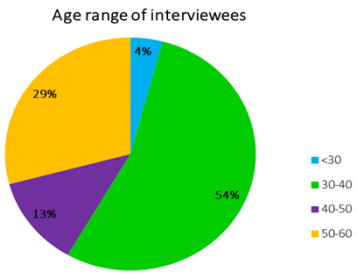
Survey – Intermediate outcomes

- How does the generic client of SIM4NEXUS look like?
  - Male
  - Aged 30-40
  - Middle manager (manage team & prepare decisions for top management) → Positioning
  - In departments CSR / Risk assessment / Strategy / Supply chain / Innovation & New projects
  - Likely to be unaware about serious games





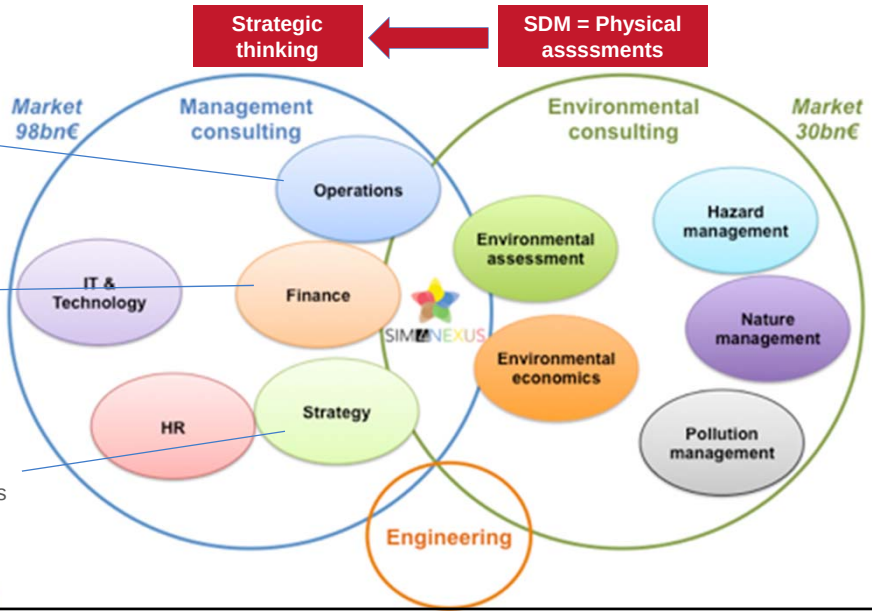


Consultancy – Concept & market assessment

- Improve resource management
- Reduce pollution
- Increase resilience

- Assess nexus risks for investment and insurances

- Develop resilient strategies
- Design nexus-related policies
- Develop nexus-resilient business models and organisations



Serious games market

- Types of games and business models

Computer-assisted board games Workshop / Train trainers

World climate | Wat Game

Board games Workshop / Train trainers

Flood control | Wat Game

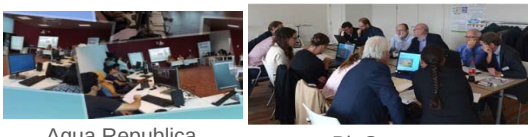
Why a serious game?

- Engage and optimise retention
- Roll out complex knowledge
- Apply knowledge
- Safe environment
- Reuse

Online free-to-play

Clim'City | Ile du Futur

Training on computer Workshop, Licensing, SaaS



Aqua Republica | BioConcept

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SIM4NEXUS

SIM4NEXUS Serious game concept tested

Present

Play random scenarios and discover the future.

Future

Knowledge Generation By Playing

Restart a new scenario, to face new situations and adjust the strategy.

Evaluation of the played scenario :

Visualization of actions taken in the game, and conclusions drawn.

Can we map the interactions?

What are the big trends?

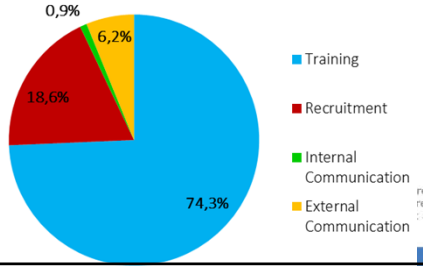
Which the obstacles? Bottlenecks? Problems?...

Serious games – Market (General)

- Serious game are mainly used by industrial companies
  - for training and recruitment
  - Serious games related to sustainability represent only 4% of the serious games

Sample of SGs in large French companies

(i) Use distribution of French industrial serious games



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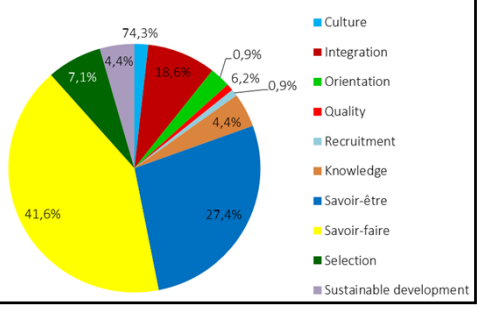
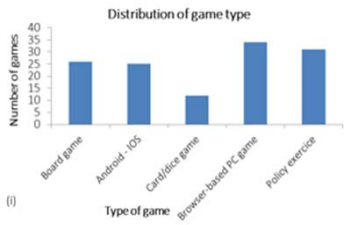
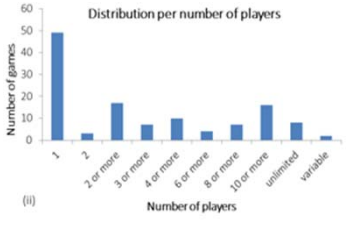
(ii) Serious games distribution vs. particular domains

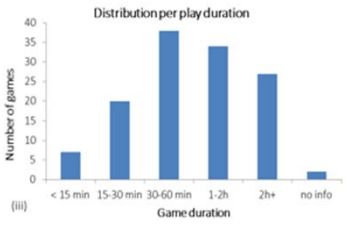


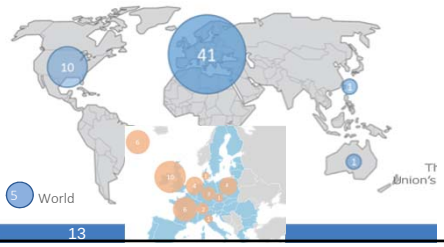
Serious games – Competition (Sustainable SGs)

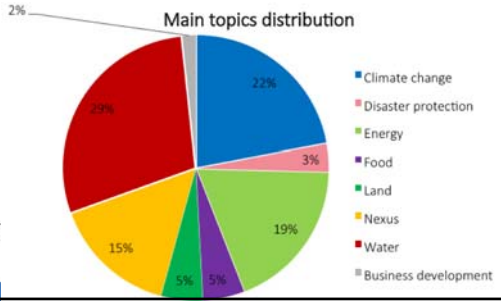
- 128 sustainable serious games identified via Game4Sustainability website

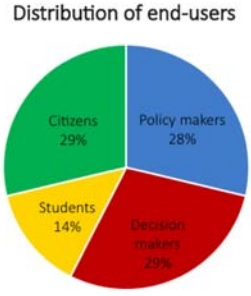












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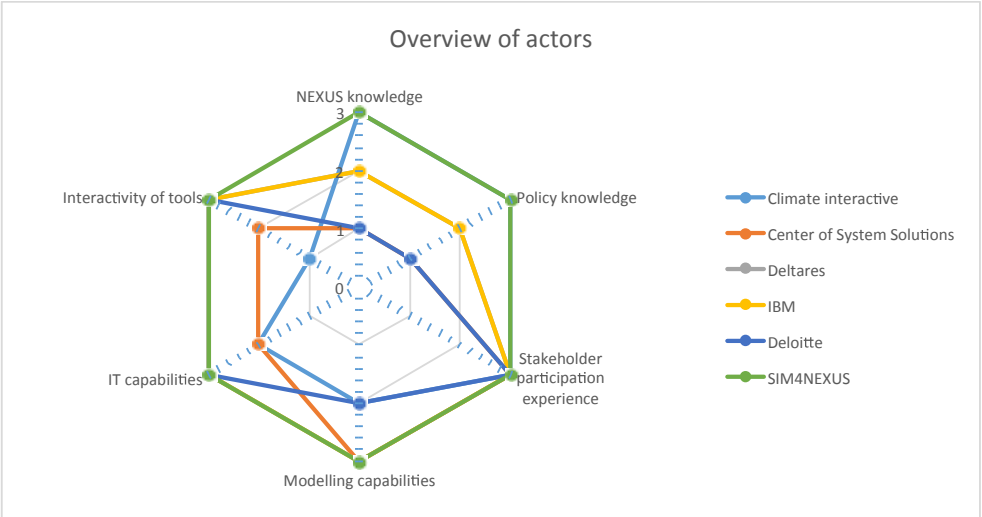
Serious Game – Competition assessment



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Serious Game – Market estimate

Assumptions	Value
Number of large companies in Europe (Eurostat)	45,000 companies
Share of serious games on sustainability (extrapolated from France)	4%
Estimated number of yearly sales for a sustainability-related serious games every year	1,800 sales / year
Assumed sell price for a Serious Game like SIM4NEXUS SG	50,000 €
Estimated market size range in Europe for a sustainability-related serious game like SIM4NEXUS	90 M€/year

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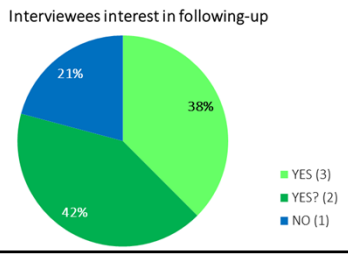
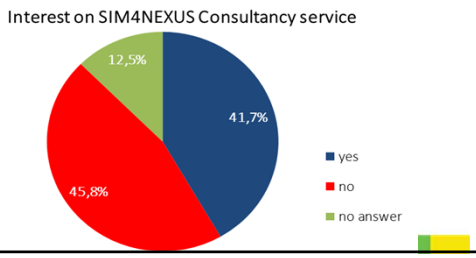
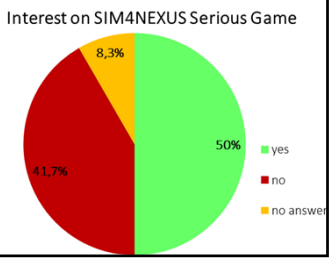
Survey – Initial outcomes

- Relative interest for SIM4NEXUS
  - In general, interest in following up with the project → ESG
  - Doubts about the feasibility of a "super-model"
  - Existing tools are satisfactory
  - Serious games are not part of the daily work
  - Applicability to local issues of interest to organisations unclear
  - Nexus cuts across silo-minded organisations → Social engineering needed

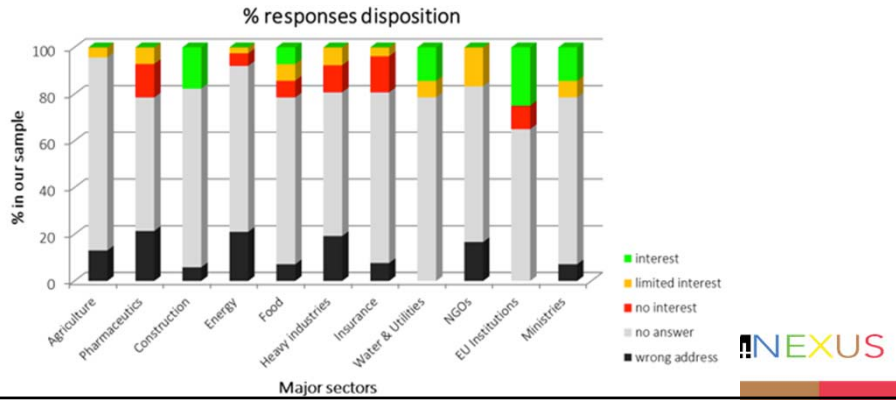






Survey – Initial outcomes

- Interest varies from sector to sector
  - Construction, Water & utilities, EU institutions and Ministries relatively interested
  - Energy, heavy industry, pharmaceuticals and insurance have low interest ???
  - Need to speak the language of each industry



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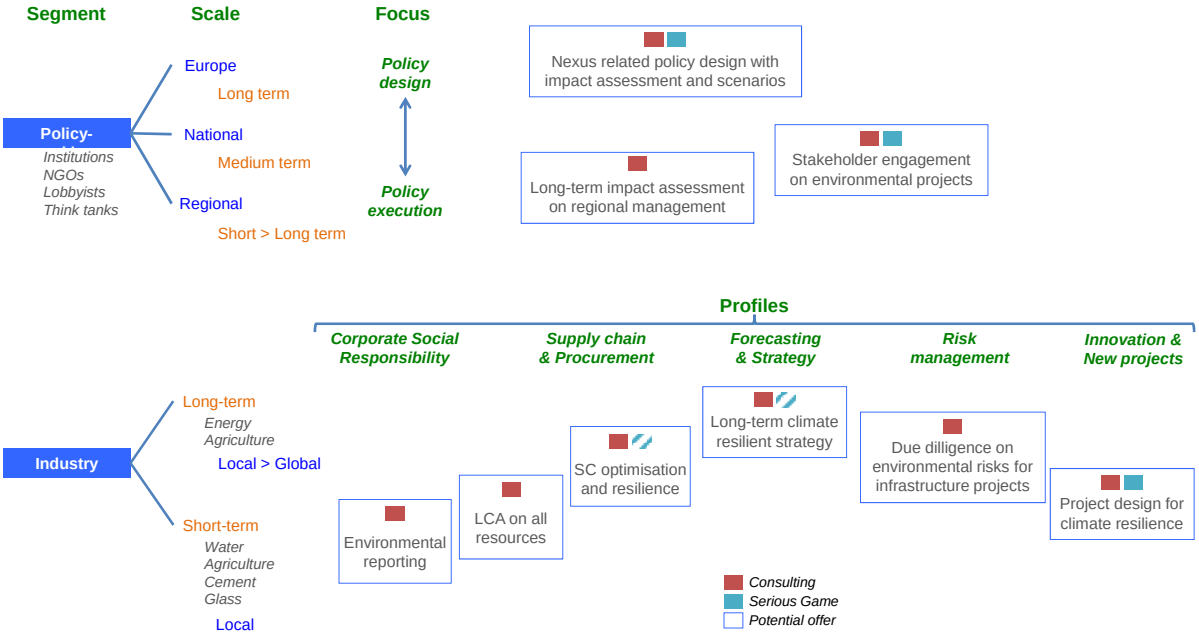
Market segmentation and potential services identified in the market study



Next steps and recommendations

- WP6
  - T6.1
    - Continue the survey
      - Replicate experience in France in other EU countries
      - Get more interviews from industry
      - Confirm interest from public institutions
  - T6.2: set up the ESG
  - T6.3: Define products and services for spinoffs
    - Define in more details the consulting offer and test with the survey / ESG
    - Support WP4 in designing the Serious Game / set interactions with ESG
    - Develop a board-game version of SIM4NEXUS SG?
- WP1 and WP3: Secure local applicability of SDM => Market
- WP5: Involve industrial cases in use cases to test applicability (especially construction, water, food)

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Advice from EAB

- Use cases
  - Public institutions
  - Industrial companies

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Thank you!

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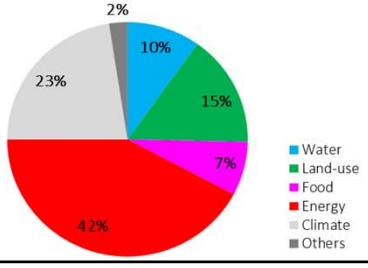
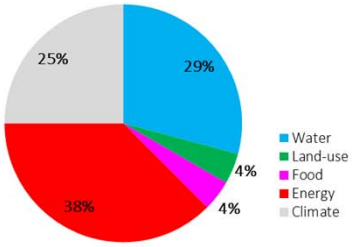
Survey – Intermediate outcome

- Survey relatively balanced in terms of nexus *(affectation by nature arbitrary)*
  - Water ultra-responsive
  - More reponses also from energy and climate
  - Land-use and food to be increased

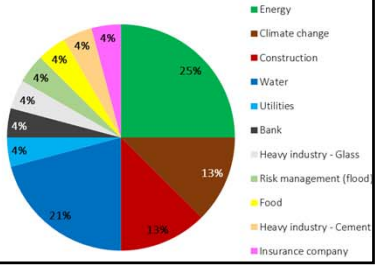
Nexus sector distribution of contacted people



Nexus sector distribution of interviewed people



Interviewees' specific expertise distribution



WP 7: Communication and dissemination

EAB Meeting

Guido Schmidt

Fresh-Thoughts Consulting GmbH

31 May 2017

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Why? Three impact goals

- **Increased understanding** by target audiences of how water management, energy, food, biodiversity and land use **policies are linked together** and to climate and sustainability goals.
- **Reduction of the uncertainties** about the **opportunities and limitations** of low-carbon options, such as bioenergy technologies and resource efficiency measures, in view of relevant near-term policy initiatives.
- **Provision of new evidence** about specific issues to future (SCIENTIFIC EVIDENCE) assessments, including those of the IPCC, with multidisciplinary and integrated tools.

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What? Our identity – messages & calls

- SIM4NEXUS envisions the Nexus concept as an **integral part of the transition towards a resource-efficient and low-carbon economy**.
- SIM4NEXUS **quantifies** the water-energy-land-food and climate nexus relationships for resource efficiency
- SIM4NEXUS **elucidates the links, trade-offs and synergies** between water-food-energy-land under climate change
- SIM4NEXUS **for synergies**, not for single policies …
- SIM4NEXUS builds on **actors' knowledge gained in the participatory approach, complexity science and a serious game** for better nexus understanding and more robust and **reliable decision-making**

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Who?

- **Nexus sector decision-makers or influencers** (including Global, EU level, national etc.) – middle-upper management level (e.g. HoU)
- **Platforms and networks** (SDSN, EIPs Water, Agriculture and Raw Materials, CGIAR, GWP, other), civil society organizations, NGOs
- **(Large to medium) Industry actors** (WBCD) and Businesses: (e.g. insurance, energy and water operators, retailers, food production companies, engineering) and Investors (e.g. World Bank Group, EIB). Support to WP6
- **Researchers & teachers**
- **Media** & general public (in case study areas)

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When?

- 3 phases
  - **Awareness-oriented** (now)
  - Results-oriented
  - Project after-life
- 'push' and 'pull' communication
- Priority list for 2017

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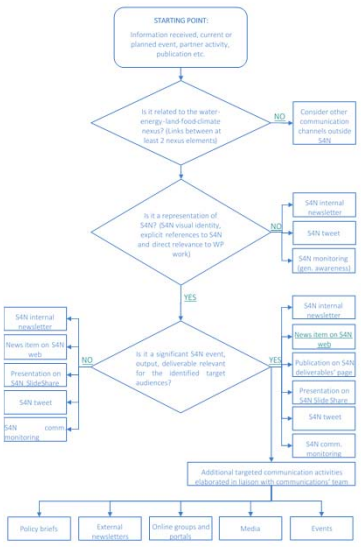
How?

- Online dissemination including social media
  - Twitter, E-newsletters, Portals, Slideshare, Videos
  - Website
- Materials
  - Visuals, templates, fact-sheets, policy briefs, public policy consultations, presentations
- Hosting and participating events
- Scientific publications
- Interviews



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How much? Effort & Impact (1/3)

Task	Product/ activity	Effort indicator			Impact indicator		
		Name	Target	Reached	Name	target	Reached
7.2	Website	Nr. of new content items published	N/A	16+	Visitor clicks	N/A	898+ unique visitors 1015+ visits
7.3	Scientific conferences/ events	Nr. of events attended	10	4+	Size of total audience reached	3000	+
7.3	Scientific publications	Publications submitted/published	10	1	Nr. of estimated users	5000	+
7.4	Case studies communication: videos	Nr. of videos published	20	0	Nr. of video 'plays'	20 000	0
7.4	Case study result briefs	Nr. of case study result briefs developed	N/A	0	Total audience reached with the briefs	N/A	0

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How much? (2/3)

Task	Product/ activity	Effort indicator			Impact indicator		
		Name	Target	Reached	Name	target	Reached
7.5	Twitter	Nr. of tweets	240	175	Twitter 'likes' and re-tweets	24 000	1173
7.5	Slideshare	Nr. of presentations posted	20	3	Nr. of visits to presentations	10 000	249
7.5	newsletters	Nr. of publications in newsletters	10X8	4	Size of audience reached	160 000	5935
7.5	external websites	Nr. of items published	10	16	Size of audience reached	20 000	+
7.5	online communities /forums	Nr. of items/discussions /posts	40	1	Size of audience reached	20 000	259

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How much? (3/3)

Task	Product/ activity	Effort indicator			Impact indicator		
		Name	Target	Reached	Name	target	Reached
7.6	flyers and handouts	Nr. developed/printed	N/A	4+	Nr. of downloads/nr. of handouts given out	N/A	315+
7.6	Promotional material:	Nr. of translations	N/A	3			
7.7	policy decision-makers: public consultations	Nr. of contributions to policy public consultations submitted	N/A	1	Nr. responses to contributions received	N/A	0
7.7	Policy briefs	Nr. of briefs published	N/A	0	Number of clicks/downloads	N/A	0
7.4, 7.7	Communication with policy decision-makers: events	Nr. of events attended	10	9	Nr.	4000	235+
7.4, 7.7	Targeted activities with media	Nr. of articles, etc.	20	0	Total audience reached	200 000	0

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Advice from EAB: Recommendations on…

- strategy, target audience, tools…
- communicating to the different nexus sectors
- Important (international) events
- focus (sector/s, tools…)?

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Thanks for your attention!

For further information please consult
www.sim4nexus.eu,
follow us at @SIM4NEXUS
Guido.schmidt@fresh-thoughts.eu

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