



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

D6.6: SIM4NEXUS LEGACY REPORT

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ADDRESSING REVISION COMMENTS	
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<ul style="list-style-type: none"> •Section 4 should also include a subsection explaining how the Serious Game and SIM4NEXUS SPACE will be made accessible after the project has ended. This is already briefly mentioned in D6.4 but it should be confirmed in this D6.6 “After the end of the project, the serious game will be made freely available, on the internet, since it is funded by the European Commission. A partner (most probably EURECAT) will host the server with the Serious Game for 2 years right after the project.” 	See additions in section 4.2.2.3. and 4.2.3.2
<ul style="list-style-type: none"> •Briefly explain how the Nexus Projects Cluster activities will be continued, what is already planned and who will take the lead on this? 	See additions in section 3.5.2.

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Executive summary

Changes with respect to the DoA

No changes

Dissemination and uptake

The document will be published on SIM4NEXUS website.

A Policy Brief of this deliverable will be prepared for SIM4NEXUS final conference.

Short Summary of results

The SIM4NEXUS legacy report describes the project's added values: the tools built, the frameworks and processes elaborated or tested, the knowledge acquired, the partnerships initiated and its role in the development of the nexus concept. For each added-value, follow-up steps are proposed to ensure the legacy and the report describes how SIM4NEXUS has targeted relevant audiences. The project has already produced some impacts which are demonstrated.

Evidence of accomplishment

The document will be published on SIM4NEXUS website.

Acronyms

TERM	EXPLANATION / MEANING
AI	Artificial Intelligence
BEF	Baltic Environment Forum
CAP	Common Agricultural Policy
CS	Case Study
CZ	Czech Republic
DG	Directorate General
DHI	Danish Hydraulic Institute
DOI	Digital Object Identifier
EAB	External Advisory Board
EU	European Union
GIS	Geographical Information System
IHE	Delft Institute for Water Education
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
JRC	Joint Research Center
KEE	Knowledge Elicitation Engine
KPI	Key Performance Indicator
KTH	Royal Institute of Technology in Stockholm
KWR	Dutch Water Research Institute
NGO	Non-Governmental Organisation
NPI	Nexus Performance Indicator
PBL	Netherlands Environmental Assessment Agency
SDM	Systems Dynamic Modelling
SG	Serious Game
UNFCCC	United Nations Framework Convention on Climate Change
UTH	University of Thessaloniki (Greece)
UK	United Kingdom
WFD	Water Framework Directive
WLEFC	Water-Land-Energy-Food-Climate
WP	Workpackage
WUR-LEI	Landbouw Economisch Instituut at Wageningen University & Research center

1 Introduction

1.1 Context of the document

Deliverable 6.6 is the main deliverable presenting the activities and results of Task 6.5 “SIM4NEXUS Legacy”. According to the Grant Agreement, Task 6.5 aims at preparing the legacy for all outputs, in harmony with the spinoff(s) created in Task 6.4. A close symbiosis between commercial and general interest activities will be mutually beneficial, as: a wide dissemination of the knowledge can serve to evangelise the market for the spinoff(s); the spinoff(s) can serve to produce general interest (e.g. designing better cross-cutting policies, educating young talents and informing citizens) and thus contribute to the overall legacy of the project.

Task 6.5 was implemented from June 2019 to April 2020 (10 months) and is led by ACTeon.

1.2 Objectives of the document

The SIM4NEXUS project has produced a wide range of knowledge and tools that are aimed at being disseminated and used more widely (by the research, decision making or civil society communities). Of key importance is to ensure that the right steps have been taken during the SIM4NEXUS project so that its results, key recommendations and tools are used, reused, adapted and further developed beyond their sole use by SIM4NEXUS partners – overall, ensuring that SIM4NEXUS leaves a legacy so its output continue to be used beyond the end of the project.

In this context, the report has two complementary objectives:

- First, to present the definition of the legacy in the context of the SIM4NEXUS project;
- Explain how the issues and challenges of legacy have been addressed during the implementation of SIM4NEXUS, and the practical steps that have been taken to ensure this legacy;

1.3 Structure of the document

Chapter 2 gives a definition of “Legacy” that is adapted to the framework of an European research project like SIM4NEXUS, describing the methodology that have been applied to address legacy along with the sources used to build this Legacy report.

Chapter 3 presents the diversity of elements that compose the SIM4NEXUS Legacy.

Chapter 4 qualifies the SIM4NEXUS legacy in terms of relevant stakeholder groups and expected potential impacts ranging from inspiration to embeddedness and institutionalisation.

2 Methodology to draft the SIM4NEXUS Legacy report

Legacy as defined here refers to all knowledge, results, concepts, tools, stakeholders' dialogues or policy recommendations that are expected to “remain alive” once the SIM4NEXUS project ends.

Examples of “Remaining alive” can mean: (a) a key principle that has been developed and that becomes embedded in a new piece of European legislation – or that is taken as basis conditionality for further research funding; (b) a tool that is used for supporting real policy making – or further developed by the research community (in particular beyond the SIM4NEXUS consortium); (c) a policy recommendation that is taken on board by governments and local authorities and integrated in a new piece of legislation; (d) an adaptation in the assessment framework used for ex-ante policy assessment; or, (e) an article on the nexus produced by SIM4NEXUS that become a key reference to/cornerstone of further research manuscripts or articles produced after the end of the SIM4NEXUS project.

2.1 Legacy frameworks for European research projects

Few published examples offer systematic approaches to pursuing legacy. Recognising this, the PLACARD¹ (the PLATform for Climate Adaptation and Risk reDuction) research project has developed and implemented such a framework that could be used in any context and project. The PLACARD **Legacy Framework** is structured as a three phase approach as described below.

2.1.1 Scoping: identifying the impact of an intervention

Legacy requires exploring three questions:

- **Which value** is added by a given project or initiative? This requires a discussion on the mechanisms through which the project adds value and generates long-term effects, creating new products, supporting change of minds and behaviour or supporting adaptations in processes and interactions among stakeholders in a structural manner.
- **For whom** is value added and how is capacity built for people who could benefit from this value around a new issue? This relates in particular to empowering individual professionals, removing structural barriers within and between institutions, connecting people to share knowledge and resources, ensuring sustainable interest and demand through engaging communities.
- How are the project's outputs **mainstreamed**? It may take the form of “inspiration”, that is, stimulating stakeholders to take on board key recommendations. Legacy could be achieved through “embeddedness”, that is, seeing that key actors adopt and maintain many of the critical functions of a tool / methodology over time. Finally, “institutionalisation” can imply making the project's teams or frameworks become the core of a new organisation or body.

¹ <https://www.placard-network.eu/the-placard-legacy-framework/>

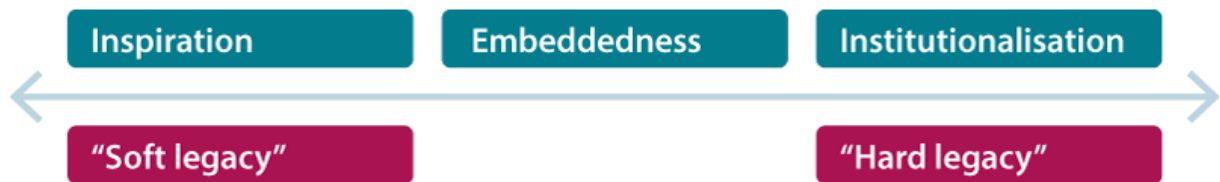


Figure 1. Approaches for facilitating legacy, taken from PLACARD.

The scoping discussions should not focus on the specifics of the legacy activities, but rather begin to gauge the appetite of both the SIM4NEXUS team for further engagement and potential end-users of our products, and begin to direct the process forward. Financing the legacy process should also be deliberated at that stage.

2.1.2 Stocktaking

In this phase, the principal activity is a stocktaking exercise that seeks to identify the concrete outputs of the programme or project, including physical products delivered (e.g. a computer-based platform) and key interactions facilitated (either within the project or outside). It requires to better understand key outputs produced in different workpackages and systematically identify the value they add and potential next steps in further development and use. In this way, the stocktaking exercise is not limited to the outputs themselves, but aims at generating information about processes that “add value” and bring actors and interested parties along to support long-term impact and use.

In this stocktaking phase, the PLACARD Legacy Framework proposes to address the following questions:

- What are the key outputs of work in this programme or project, including products and important interactions facilitated?
- For each output, what is its value added? To whom is this valuable?
- What concrete actions could be taken to assure the long-term impact (or use) of this output?
- Which key partners should be part of this conversation and participate in future concrete actions?

While the questions have similarities with the ones raised in the scoping phase, their focus is much more specific here – looking at individual products and results versus looking at the project as a whole in the scoping phase.

2.1.3 Strategizing

In this phase, a series of discussions or workshops, called legacy dialogues, are convened amongst project partners and other relevant actors who are likely to have “value” from the project results and outputs, assuring all key players and stakeholders are around the table to develop a strategy for ensuring the legacy of the project.

2.2 SIM4NEXUS preparatory activities

The goal of activities carried-out by all Partners in the framework of Task 6.5 is to ensure that SIM4NEXUS results will continue to live once the project is over and the consortium split.

To facilitate long-term impact and get prepared for legacy, the legacy issue was considered early-on in the SIM4NEXUS project implementation. Task 6.5 kick-started in early July 2019, taking the opportunity of the SIM4NEXUS project meeting to raise awareness on legacy issues and to collect preliminary ideas from all consortium partners.

The preparatory activities had to follow an adaptative approach in a wide variety of contexts, as the project's activities and outputs range from modelling, policy assessment, Serious Games or stakeholders' engagement. A legacy concept note was circulated among project partners to shortly present activities proposed for addressing legacy and their related time schedule.

2.2.1 Collection of Partners' feedbacks

Legacy workshop (July 2019)

A first group discussion was organised with all Partners during the SIM4NEXUS project meeting in Riga (Latvia) in July 2019. The goal was to introduce the concept of "legacy", start getting organised over the remaining year of the project to ensure maximum impact and contribute to the exploitation strategy of the project. The outcomes of this first legacy workshop are presented in Appendix A.

Brainstorming session on added-values (March 2020)

The identification of SIM4NEXUS added-values was carried-out during the SIM4NEXUS online project meeting organised in March 25-26, 2020. The brainstorm session mobilised 50 participants from the consortium, split in two groups. Partners first identified the SIM4NEXUS added values in terms of: tools, concepts, processes, knowledge and partnerships. Once a list of potential added-values was produced, participants were invited to rank propositions and give their opinion on the strongest added-values of the project. The outcome of the work of the groups are presented in Appendix B.

Survey addressed to Partners and Task leaders (April 2020)

In order to complete the information retrieved from SIM4NEXUS deliverables, monitoring tables or monthly news, partners were individually contacted to report on their individual initiatives contributing to the Legacy of the project. The questions focused mainly on the improvement of existing tools (such as thematic models), the development of partnerships stemming from SIM4NEXUS consortium as well as the partners intentions to use the SIM4NEXUS results once the project is over.

2.2.2 Review of SIM4NEXUS document

Much information on the SIM4NEXUS added-values, successes and impacts are already available through the large number of SIM4NEXUS' written products, in particular:

- The **deliverables** that describe the project's activities, methodologies and results. Their conclusions are enlightening as to the added-values of the project as well as the gaps that remain to be covered – during the project implementation or beyond the end of the project for the deliverables recently produced;
- The quarterly **monitoring of communication activities** of the project that gives an overview of the efforts made to reach out different communities and to spread the SIM4NEXUS messages and lessons-learnt to different target groups;
- The **monthly newsletters** of the project's coordinator that flag the project's or partners' successes and achievements.

These products were also analysed for supporting the development of the present report.

2.2.3 Collection of externals' feedbacks

The SIM4NEXUS Legacy was also confronted to the perception of people that are external to the project consortium :

- The **External Advisory Board** (EAB) met on March 27th, 2020 to be presented with the achievements of each SIM4NEXUS Workpackage. They expressed views on the added-values of the project and gave advice on how to implement the final activities of the project to achieve stronger legacy. These feedbacks are taken into account in the present report.
- The **Case Studies stakeholders'** will be contacted in May 2020 to fill-in a short survey dedicated to monitoring the project's performance indicator KPI5, a measure of the impact each case study had (or thinks it had) on the understanding of the Nexus-related issues, challenges and solutions by the local stakeholders.
- The **end-users of the Serious Game** will be contacted in May 2020 as well to fill-in a short survey dedicated to monitoring KPI6. The will help measuring the interest potential end-users might or could have on using the Serious Game after the end of the project.
- The **young professionals** who worked on SIM4NEXUS have also been polled to understand the impact the project might have on their career. The online survey dedicated to Young professionals will be completed by semi-structured interviews to understand in depth the way the project and the partner organisations influenced their professional development. The results will be valued through a publication and the SIM4NEXUS final event.

2.2.4 Overview of SIM4NEXUS preparatory activities to ensure legacy

The above described activities have been designed to follow the PLACARD legacy framework.

Scoping	<p>Discussions on the added-value of our research work have been on-going since the project started. Each scientific article published, deliverable released or talk made at a conference is an occasion to reflect on the benefits or progresses achieved by SIM4NEXUS and to compare with other projects. Some of them were highlighted in the monthly newsletters of the project.</p> <p>Financing the legacy process was also an early concern, as it became apparent that 1/ the SIM4NEXUS budget was insufficient compared to ambitions and 2/ the legacy activities had to continue after the project's end date.</p> <p>Most discussions took place among WP6 Partners and were regularly shared with the other WP leaders.</p>
Stocktaking	<p>The annual project meetings' agendas always included sessions to share lessons learnt and achievements. The EAB of the project is also central to point out the added-values of SIM4NEXUS, as they bring in their knowledge of the research gaps. Central to this step was the session organised in March 2020 on the "added-values of SIM4NEXUS" during the annual project meeting. All added-values were collected and ranked, giving an overview of the most significant ones. The review of SIM4Nexus documents as well as the survey addressed to partners were used to further describe the added-values.</p>
Strategizing	<p>SIM4NEXUS early on developed a strategy for the dissemination and communication of project's results (see Deliverable D7.1) as well as the exploitation of the project's products (see Deliverable D6.1). They both strongly contributed to the legacy. In addition, a legacy concept note was circulated among Partners to clarify the specific legacy activities listed above.</p>

The following chapters also follow the PLACARD framework by answering:

- Which value is added by the project (chapter 3) ?
- For whom value is added and how the targets are reached (chapter 4.1) ?
- How are the project's outputs mainstreamed (chapter 4.2) ?

3 Identifying the SIM4NEXUS added-values

The following paragraphs present the different components of the SIM4NEXUS added value that have been identified and discussed within the consortium and with other associated experts and actors.

3.1 SIM4NEXUS and the nexus concept

3.1.1 Raising interest in the nexus concept

For stakeholders being involved in the project's case studies, SIM4NEXUS was often **the first encounter with the nexus word**. Note that in some cases, European stakeholders feel more comfortable using the terms, and discussing the challenges and solutions, of enhanced policy coherence and effective synergies between policies – without using the term nexus that remains rarely used in EU, national and regional policy making in Europe.

SIM4NEXUS also contributed to debates within the nexus (mainly scientific) community regarding **the definition and use of the term**. First, SIM4NEXUS expanded the usual water-energy-food nexus by adding the land and climate dimensions ([Laspidou, 2018](#)). In August 2018, SIM4NEXUS issued a [commentary to SEI report](#) 'Where is the added-value? A review of the water-energy-food nexus literature' to demonstrate the relevance of the nexus concept the project has been developed and made operational.

The SIM4NEXUS partners have acquired a better and deeper understanding of the nexus concept through the project, which will help them disseminate and teach it as well as demonstrate its advantages to support decision-making. The power of the concept will be supported by the wealth of results and products from SIM4NEXUS.

3.1.2 Supporting a change of mind towards more integrated thinking

Be it through the visualisation tools, the cross-sectoral workshops and the multi-disciplinary collaboration, SIM4NEXUS contributed to **open people's views on the other nexus domains** (a) within the SIM4NEXUS consortium itself and (b) in the different case studies implemented by the project.

The research carried out and the tools developed help making links between sectors more explicit, demonstrating cause-effect relations and quantifying impacts. One of the very first results of SIM4NEXUS, the **summary table of all nexus interlinkages** (published in [Deliverable D1.1](#)) was central to help out all partners to gain knowledge of the many dependencies between water, energy, food, land and climate. When demonstrated to stakeholders in some of the case studies, these tools can help capturing in a very complex system the important links between sectors and policies that require specific attention.

Through publications or oral interventions, SIM4NEXUS partners made efforts to connect better the different sectors. For instance, the SIM4NEXUS [Deliverable D5.2](#) describes all 12 case studies from a nexus perspective, highlighting the major conflicts between land-water-energy-food-climate resources. Energy practitioners were informed of water innovations in the Autumn 2019 edition of the [European Energy Innovation Magazine](#). Other such cross-sectoral communications will be required in the months following the end of SIM4NEXUS to support this change of mind.

3.1.3 Shedding light on the strengths and weaknesses of a nexus approach

As highlighted in the contributions of the partners to the March interactive legacy workshop, the project helped assessing the strengths and weaknesses of nexus thinking. While the tools and models help **capturing “at once” all sectors** and deliver a wide range of results, their complexity do not always help truly understand what drives the system, the key nodes and links that are essential to tackle in priority and the solutions that would be required to enhance the functioning of the system and policies to optimality. This was further stressed by the participants in the Serious Games sessions organised by Strane and by some stakeholders participating in the case study stakeholder workshops.

Among the challenges of a nexus approach, is semantics. Working across sectors and scientific domains requires first to develop a common language. SIM4NEXUS has created **a glossary** dedicated to nexus studies, regularly updated and enriched as the project unfold.

Other challenge of such complex frameworks is to **deal with uncertainty**, both in modelling tools and in decision-making or behavioural change. The [Deliverable D1.4](#) classified the different sources of uncertainties and reviewed available methodologies for their identification, analysis and communication in different contexts.

Note that understanding the strengths and weaknesses of a new concept is not negative, but has clear added value. Indeed, making a step towards operationalising a new concept similar to what SIM4NEXUS has done helps giving light on a range of unforeseen challenges – in terms of technology, people’s minds and perceptions, institutional barriers, etc. – and on what can be reasonably expected from the operational implementation of the concept. This will be further strengthened when the SIM4NEXUS consortium identifies the range of questions and issues (knowledge gaps and science-policy interface challenges) that remain to be tackled for moving the nexus forward at different scales and for different communities.

3.2 SIM4NEXUS tools to address the nexus complexity

3.2.1 Connecting qualitative and quantitative data through the SDM tool

The translation of policies (objectives or instruments) into quantitative data is a major step towards integration across sectors. The SDM tool has been central to **connect datasets from a diversity of sources**, covering water, energy, land and food resources, accounting for climate changes, as well as integrating the influence of policies. The [principles have been described in an article](#) published in Resources, Conservation & Recycling (Susnik, 2018) and examples of applications to case studies have been [published for Sardinia](#) (Masia, 2018). The methodologies for the application of Systems Dynamics Modelling to all 12 case studies is reported in [Deliverable D3.4](#) and the overall assessment of this approach will be published in June 2020 in [Deliverable D3.7](#).

Now that the feasibility of use of the SDM has been demonstrated for a diversity of nexus challenges, further work is required to facilitate the replicability to other case studies and the addition of new nexus domains (such as biodiversity). Legacy would be ensured if future SDMs could build upon the ones developed in SIM4NEXUS.

3.2.2 Testing policy scenarios through the SDM tool

Once fully developed for the 12 case studies, the SDM can help assessing the implications of different scenarios for the 5 nexus sectors considered. It allows opportunities to further **investigate the likely impacts** of the policy choices of a given sector on other sectors, or to **search for solutions** that will deliver better optimal outcomes.

As the SDM does not integrate the full range of decision-making processes and functioning of the economy that relates to all nexus sectors, its use for assessing the impacts of changes in economic instruments and markets remains somewhat limited. It then needs to be combined with existing models that are able to capture the likely impact of these changes on sectors behavior, practices and choices.

At that stage, the SDM can **support policy development** (see 4.2) providing it is manipulated and interpreted by experts of SDM tools. An ambitious evolution would be to use the SDM as a decision-support tool which would allow trained practitioners to use it. The improvement of the socio-economic dimension in the SDM, in addition to the existing interlinkages in natural resources, would better meet the needs of stakeholders involved in policy development.

3.2.3 Visualising the complexity of interactions across natural resources via Nexus Performance Indicators (NPI)

One difficulty of the nexus concept is the awful complexity of relationships, indirect links and feedback loops between sectors which makes it hard to read at first and to fully comprehend.

The visualisation² developed for the global and European scales help capturing these interactions in a user-friendly manner. It helps in particular identifying causal relationships that are important and the ones that are marginal, an information that might be sufficient to guide policy makers to “what matters most” before more detailed comprehensive studies are carried out on the key relationships. The Greek case study has also proposed innovative visualisations of its results ([Laspidou, 2020](#)), highlighting the conflicts for natural resources use and the interlinkages across sectors.

The development of synthetic and easy-to-read indicators and graphics in SIM4NEXUS is a strong added-value for the nexus community who struggles to popularize the research results and find the right balance between 1/ catchy visuals for non-expert audiences and 2/ strong scientific background. The replication of such visuals for the other case studies in the project is on-going. It will allow for comparisons between regions or countries, illustrating the diversity of nexus challenges and the strength of the nexus concept. It will also support further work by the case study leaders, well after SIM4NEXUS ends, to contribute to policy development or analysis.

3.2.4 Experimenting the nexus with the Serious Game in a playful manner

The [SIM4NEXUS Serious Game](#) enables players to implement policies in a game play environment and **explore how policies impact on different nexus components**. Policies are implemented using policy cards, which combine summary information about policy actions, costs and potential benefits with an element of strategic intrigue. The game includes a strategy map that facilitates comparison of policy impacts in different regions, a tech-tree that allows users to make decisions regarding investment into

² The visualisations are built on the web infographic interface <http://sankeymatic.com/build/>

certain technologies, a virtual card table in which policy cards can be applied through a drag-and-drop interface, and a visualization system that shows the impacts of users' decisions on the model.

The tests carried out with different audiences (a majority of students and some tests with stakeholders/policy makers) stress that the serious game helps players to **capture the complexity of the nexus and the main connections, synergies and incoherence between sectors and policies.**

The application of the SIM4NEXUS serious game for training and education will be described in [Deliverable D5.8](#) (due in June 2020). Many partners plan on using the serious game in the next school years as support to courses over the nexus. There are also plans (e.g. in the Baltics) to raise awareness among NGO's on the many dependencies and interlinkages between natural resources, to strengthen their messages. The strategy of exploitation of the serious game is detailed in the [Deliverable D6.3](#) and the business model is detailed in the [Deliverable D6.4](#), both released in June 2020.

How the serious game can effectively guide policy makers in scoping what the right set of instruments and policies could or should be is an area that will require further investigations beyond the end of the project, but for which there is high interest from different partners.

3.2.5 Providing tools for capturing lower and better consumption (efficiency) of natural resources

The conceptual models, SDM, NPI and serious games developed in SIM4NEXUS account for the limited availability of natural resources. These tools help in particular capturing how one resource used by one sector directly impacts other sectors as less resources are available for them.

The policy scenarios developed by the 12 case studies, built on the existing research results regarding socio-economic pathways as well as innovations for low-carbon development (see [Deliverable D1.8](#)), demonstrate **how the different policy instruments can be used.**

As a legacy, SIM4NEXUS offers a range of tools (conceptual models, SDM, NPI and serious games) that help grasp the interdependencies and unbalances in natural resources use, contributes to measure the gap to be covered for a more sustainable use of resources and allows for testing how policy instruments close this gap. The challenge, once the project is ended, will be to mainstream these tools in policy processes and clarify when, how, with whom to use them. Policy development and policy assessment are the key steps to be targeted for applying the SIM4NEXUS tools.

3.2.6 Applying AI tools adapted to nexus studies through the Knowledge Elicitation Engine (KEE)

The KEE has been used to connect the policy cards, the SDM and the NPI for the different case studies of the project. The Sardinia and Greek case study served as front-runners for the development of the KEE, as described in [Deliverable D4.3](#). Once the KEE was ready for these two case studies, the implementation of additional SIM4NEXUS case studies was a quick and flawless task.

Applying the KEE to new case studies after the end of the SIM4NEXUS project would clearly be possible without extra developments. This tool should therefore be made available for new nexus research projects or initiatives.

3.2.7 Paving the way towards innovative decision-support tools

The Serious Game final version, described under [Deliverable D4.5](#), helps identifying new areas for supporting policy making that are complementary to more traditional approaches built on studies and

(complex) modelling carried out by researchers and consultants. If applied by experts and decision makers involved in policy making, the serious game offers the possibility to:

- help people **capturing complexity** and interconnections between sectors;
- **screen challenges** – identifying the most important causal links, connections and incoherence;
- scope and **prioritise policy changes** needed for enhancing policy coherence and achieve policy objectives cost-effectively.

Built on the SDM, the Serious Games lacks a reliable socio-economic component to capture the potential social and economic impacts of the possible policy instruments (referred to in the serious game as policy cards). As this component is key to decision making, strengthening it in the serious game (and in its related SDM) is clearly an area for work beyond the end of the SIM4NEXUS project.

3.3 SIM4NEXUS frameworks and processes

3.3.1 Mobilising stakeholders to strengthen the scientific & institutional capacity to address nexus issues

The SIM4NEXUS Partners learned to work across disciplines and to mobilise social sciences when mobilising stakeholders in the different case studies. This helped establishing a shared language between communities that have little in common. The **naming convention** is a major step to facilitate dialogue across disciplines and combination of heterogenous datasets, and it can be replicated for other research initiatives. The case study development process was first described for the [Sardinia case study](#) (Susnik, 2018) and later developed from the combination of all 12 case studies in a **comprehensive framework** (see upcoming [Deliverable D1.5](#)).

The framework derived from the SIM4NEXUS experience shall be base ground for the development of new nexus initiatives. The dissemination of Deliverable D1.5 will be paramount to ensure that other organisations know it, understand it and use it. This dissemination task will have to be taken up by the partners involved in the exploitation of the project.

3.3.2 Combining social approaches and modelling for supporting the emergence of "best nexus solutions"

SIM4NEXUS established an **iterative and inclusive approach at the interface between science and policies**. The principles have been described in [Deliverable D5.1](#). A dialogue could be established between researchers, practitioners and decision makers. Achievements of the joint science-policy approach has been illustrated by case studies such as [in Andalusia for the development of the conceptual model](#) (Martinez, 2018).

Building on the commitment and skills of partners in charge of the case studies for mobilizing relevant stakeholders, attention could be given to the dynamics of the policy processes and institutional challenges and solutions that were not embedded into the different tools, in particular: policy development steps and timelines, duration of implementation, reversibility of the policy measure, institutional constraints faced by different policy cards, social acceptability issues, etc.

Depending on the case studies, the combination of modelling and stakeholder processes has helped identifying new solutions that are seen as more adapted to the nexus context as compared to current policies. The lessons learnt from this iterative process shall be analyzed in order to draw good practices in designing best nexus solutions.

3.3.3 Revealing conflicts and synergies within a nexus perspective via the policy score

The coherence analysis among nexus-related policies identified conflicts and synergies between the different policies that have been considered. The **Nilsson's scoring** was applied to all 12 case studies, allowing for comparisons between the different (from regional to global) scales. The results obtained have been published in two reports for the International and European scale (see [Deliverable D2.1](#)) and for the transboundary, national and regional scales (see [Deliverable D2.2](#)).

SIM4NEXUS demonstrated the potential of Nilsson's scoring for nexus studies. This work has been presented at EU level and could be better communicated at national or regional level as well in order to promote this method in policy assessments – thus supporting easier and better nexus thinking.

3.3.4 Proposing options to combine thematic models results

The complementarity and heterogeneity of thematic models chosen to support SIM4NEXUS has been analysed early-on in the project (see [Deliverable D1.3](#) and [Brouwer & al., 2018](#)). Options have been proposed to cover the gap between models (see [Deliverable 3.1](#)): harmonise data, align scenarios and time horizons, apply the methodology to a 'fast-track' case study, set common reporting templates.

The combination of several models' results and local datasets helped close the gap and cover all nexus domains relevant for the case studies' issues. In addition, the work carried out by different thematic modellers for addressing in parallel similar policy questions and issues has helped building bridges between different "sector modelling" communities, a positive outcome expected to **impact future modelling development and activities better accounting for inter-sectoral links and connections**.

The lessons learnt and good practices shall be capitalised to support other research teams facing model integration issues.

3.3.5 Building on case studies to cover a wide range of nexus challenges and solutions

Thanks to its 12 case studies, SIM4NEXUS has been able to address a wide range of nexus challenges: as a result, it offers a **"library" of context, approaches and solutions** that everyone in Europe and beyond can use as source of inspiration.

Further work in new case studies after the end of the project will help capturing whether the issues and solutions addressed in SIM4NEXUS can be extrapolated and replicated "as such", or whether some contextual adaptation is required anyway. Note that adaptations remain important from a process point of view to capture context specific challenges and to bring the different nexus sectors and communities of a new case study on board so a common shared understanding of nexus challenges and solutions is developed.

The policy recommendations stemming from the 12 case studies will be summarised in the upcoming [Deliverable D5.6](#) and strategies towards a low-carbon and resource efficient Europe will be developed under [Deliverable D2.5](#) to be published in June 2020.

SIM4NEXUS could investigate how the "library" which has been built can be embedded into existing collections of case studies related to nexus studies.

3.3.6 Defining useful criteria for successful policymaking with a nexus perspective

The criteria to judge a policy in the water-land-energy-food-climate (WLEFC) nexus as successful were defined for the output and impact of the policy as well as for the policy-making process in [Deliverable D2.3](#). These success factors will be tried out in other interdisciplinary projects where PBL is involved.

3.4 SIM4NEXUS knowledge

3.4.1 Producing datasets on a monthly timestep up to 2050, for 12 case studies, for 5 nexus domains

SIM4NEXUS Partners collected datasets for the 12 case studies covering the project's 5 nexus domains: water, energy, land, food and climate. The data was processed to a monthly timestep and projections were made up to 2050 on the basis of trends provided by the thematic models. Well **shared and made accessible** online, this knowledge base will be used for future research activities.

3.4.2 Identifying gaps in the understanding of the Nexus

Addressing already a complex interconnected system, SIM4NEXUS did not cover everything! The aim of the project is not to systematically reveal gaps, though the tasks performed in the different WPs helped identifying key issues that would **need further attention in future projects**. For example: (a) widening the water focus – from “water availability” to other water management dimensions related to floods e.g. (key in a climate change context); (b) giving due consideration to biodiversity and ecosystems, an area considered by some Partners (see [Hülsmann, 2019](#), the UTH membership in the [IPBES expert group](#) or the “Nexus Concept” under development by UTH and KTH for publication in [Deliverable D1.5](#)).

SIM4NEXUS final events and latest deliverables should stress upon such gaps so the nexus research community can take them up and work on solutions in the future.

3.4.3 Illustrating land-use changes as a major factor of climate change

The mechanisms leading to climate modifications has been explained in a SIM4NEXUS article for Czech Republic ([Hesslerova, 2018](#)). SIM4NEXUS also demonstrated that political choices such as the development of bioenergy has significant trade-offs for land-use and therefore climate objectives, [questioning the compatibility with SDGs](#) (Humpenöder, 2018). These research results legitimate the **inclusion of land and climate within the Nexus** (see also chapter 3.1.1), which SIM4NEXUS anticipated while designing the project proposal.

To ensure legacy of this added-value, SIM4NEXUS partners have to work both:

- Towards policy-makers, to ensure that the research results are translated into policy measures,
- Towards the nexus community, to ensure that “land” is correctly addressed.

3.5 SIM4NEXUS new partnerships

3.5.1 Establishing links between stakeholders from different sectors

In support of its case study activities, SIM4NEXUS has organised and implemented stakeholder processes involving a wide diversity of stakeholders from different sectors. In many occasions, and as pointed out by the different workshop evaluations and stakeholder interviews carried out, these have been the occasion of sharing views and understanding between experts involved in different fields that have otherwise limited opportunities for interacting and working together. In addition to understanding more deeply the issues of the other sectors, the partners and stakeholders involved also learned about **how different sectors were managed and their governance** : roles and share of responsibilities, powers and influences, steps in decision-making process, etc. Although it is too early to assess it, it is expected that some of the new contacts taken will deliver in the long-term new

(smoother) working relationships between individuals working in different sectors. It would be interesting to investigate if and how the cross-sectoral dialogues initiated under SIM4NEXUS have contributed to break the silos within organisations (less barriers between departments e.g.) or between organisations (inviting energy experts to water projects e.g.).

3.5.2 Contributing to the creation of a network of nexus researchers

The SIM4NEXUS consortium, and its Steering group in particular, have been very active in establishing connections to other Nexus-related projects (see [Deliverable D8.2](#)). In particular, it has initiated exchanges with over research projects addressing the nexus to launch the nexus Project Cluster in march 2018.

The [Nexus Projects Cluster](#) was initiated by projects SIM4NEXUS, DAFNE and UNU-FLORES. The 22 projects address several policy domains including sectoral policies (e.g. energy, climate, environmental and agricultural), as well as cross-sectoral policies (e.g. resource efficiency, circular economy).

The Cluster activities are the following:

- **Organising workshops** in Brussels to disseminate results,
- **Contributing to conferences**, such as the [Dresden nexus Conference](#) where the Cluster proposed to host a session to promote existing research and innovations in H2020, as well as identify challenges in nexus research and indicate knowledge gaps.
- **Publishing a Handbook** on the Water-Energy-Food Nexus

The Cluster has also taken the initiative to prepare [a response](#) on the proposal for **Horizon Europe**, as nexus and complexity still play a too little role in defining Horizon Europe, whilst policy reality is usually much more complex.

The nexus Project Cluster organised a second workshop 'Methods, tools and data for policy support on the Nexus' in Brussels on October 29, 2019. The purpose of this workshop was to showcase the achievements from research projects in defining the resource nexus, including the development of methods as well as the use of tools and available data. In addition, knowledge gaps are made explicit. Some 40 people participated, and the workshop did bring together EU-funded projects related to the resource nexus as well as other (non-EU funded) related initiatives with the objective to stimulate peer-to-peer and science-to-policy discussions on how to get the most out of nexus research for the benefit of society and policymaking.

The Nexus Cluster activities are on-going under the leadership of Wageningen Research, KWR and UTH. The planned activities include the publication of a Handbook on the WEF Nexus, the setting of a research agenda on the Nexus³, participation to conferences and managing the network of research partners involved in Nexus issues.

SIM4NEXUS results and the knowledge generated will also be ground floor for the birth of new projects or expansion of the existing findings in the context of the [Water Europe Working Group Nexus](#), led by Floor Brouwer and involving several consortium members. Water Europe is also planning to organize a targeted event on Water Projects in which SIM4NEXUS will be invited to share its results (target audience is researchers, technology developers, European commission policy makers and officials, problem owners and solution providers).

³ This goal was reached during the Dresden Nexus Conference 3-5 June, 2020. The Nexus Project Cluster, together with EASME, organised a session entitled 'Towards a nexus knowledge agenda' attended by 170 people. See outcome on : <https://www.nexuscluster.eu/News.aspx>

New partnerships are also being built, following the SIM4NEXUS approach and concepts, on other geographic areas, such as the Central and Eastern European countries (on-going initiative from BEF and the Global Water Partnership).

Recently, some SIM4NEXUS partners have formed a team (Sewers4COVID) to participate in the [EUvsVirus hackathon](#). People from University of Exeter, UTH, KWR and Eurecat participate in the team.

3.6 Synthesis of SIM4NEXUS added-values

3.6.1 Target groups for SIM4NEXUS added-values

SIM4NEXUS added values		Target groups
SIM4NEXUS and the nexus concept	Raising interest in the nexus concept	Researchers, consultants, practitioners, policy-makers, students from all sectors, at all scales
	Supporting a change of mind towards more integrated thinking	Researchers, consultants, practitioners, policy-makers, students from all sectors, at all scales
	Shedding light on the strengths and weaknesses of a nexus approach	Researchers or experts of the nexus
SIM4NEXUS tools to address the nexus complexity	Connecting qualitative and quantitative data through the SDM tool	Researchers specialised with SDM
	Testing policy scenarios through the SDM tool	Researchers and students specialised with SDM and policy experts
	Visualising the complexity of interactions across natural resources via NPI	Researchers, consultants, practitioners, policy-makers, students from all sectors and at all scales
	Experimenting the nexus with the serious game in a playful manner	Policy-makers and practitioners from all sectors and at all scales, students
	Providing tools for capturing lower and better consumption (efficiency) of natural resources	Policy-makers and practitioners from all sectors and at all scales
	Applying AI tools adapted to nexus studies through the KEE	AI and nexus researchers or experts
	Paving the way towards innovative decision-support tools	Socio-economic researchers and experts, SG developers
SIM4NEXUS frameworks and processes	Mobilising stakeholders to strengthen the scientific and institution capacity to address nexus issues	Nexus researchers, policy experts, stakeholders processes facilitators
	Combining social approaches and modelling to support the emergence of “best nexus solutions”	Nexus researchers, policy experts, stakeholders processes facilitators
	Revealing conflicts and synergies within a nexus perspective via the policy score	Policy experts and policy-makers
	Proposing options to combine thematic models results	Model teams of researchers
	Building on case studies to cover a wide range of nexus challenges and solutions	Nexus researchers
	Defining useful criteria for successful policymaking with a nexus perspective	Policy experts and policy-makers

SIM4NEXUS added values		Target groups
SIM4NEXUS knowledge	Producing datasets on a monthly timestep up to 2050 for 12 case studies, for 5 nexus domains	Research community
	Identifying gaps in the understanding of the nexus	Nexus community
	Illustrating land-use changes as a major factor of climate change	Researchers, consultants, practitioners, policy-makers from all sectors and at all scales
SIM4NEXUS new partnerships	Establishing links between stakeholders from different sectors	Researchers, consultants, practitioners, policy-makers from all sectors and at all scales
	Contributing to the creation of a network of nexus researchers	Nexus community

The analysis of this table leads to the identification of 4 target groups for SIM4NEXUS legacy (a) the research community; (b) public decision makers and stakeholders contributing to policy making development and implementation at different scales; (c) teachers and students; (d) representatives from the private sectors.

3.6.2 Follow-up steps for SIM4NEXUS added-values

SIM4NEXUS added values		After SIM4NEXUS
SIM4NEXUS and the nexus concept	Raising interest in the nexus concept	Keep promoting the nexus concept in future work and communications
	Supporting a change of mind towards more integrated thinking	Continue addressing other sectors in your communications and taking into account the other sectors in your own field of expertise
	Shedding light on the strengths and weaknesses of a nexus approach	Identify the range of questions that remain to be tackled to push forward the nexus concept
SIM4NEXUS tools to address the nexus complexity	Connecting qualitative and quantitative data through the SDM tool	Build upon SIM4NEXUS SDMs to address new nexus challenges and cover new regions and countries
	Testing policy scenarios through the SDM tool	Improve the socio-economic dimension to meet the needs of policy-makers
	Visualising the complexity of interactions across natural resources via NPI	Replicate the visuals of the Global and Greek case study for the other 10 case studies
	Experimenting the nexus with the serious game in a playful manner	Investigate how the SIM4NEXUS serious game supports policy development
	Providing tools for capturing lower and better consumption (efficiency) of natural resources	Clarify when, how, with whom to use the SIM4NEXUS tools in the policy development or assessment process.
	Applying AI tools adapted to nexus studies through the KEE	Use the SIM4NEXUS KEE in new research projects or nexus-related initiatives
	Paving the way towards innovative decision-support tools	Strengthen the socio-economic dimension in the serious game to provide reliable impact assessments of policy choices

SIM4NEXUS added values		After SIM4NEXUS
SIM4NEXUS frameworks and processes	Mobilising stakeholders to strengthen the scientific and institution capacity to address nexus issues	Disseminate the naming convention and the case study development framework
	Combining social approaches and modelling to support the emergence of “best nexus solutions”	Draw good practices in using the science-policy interface to support the identification of best nexus solutions
	Revealing conflicts and synergies within a nexus perspective via the policy score	Advertise Nilsson’s scoring for policy assessment with a nexus perspective
	Proposing options to combine thematic models results	Capitalise lessons learnt and good practices in model integration
	Building on case studies to cover a wide range of nexus challenges and solutions	Contribute the 12 SIM4NEXUS case studies to European or worldwide collections of nexus related case studies
	Defining useful criteria for successful policymaking with a nexus perspective	Try out the criteria in other interdisciplinary projects
SIM4NEXUS knowledge	Producing datasets on a monthly timestep up to 2050 for 12 case studies, for 5 nexus domains	Share the datasets in publicly accessible platforms
	Identifying gaps in the understanding of the nexus	Ensure the gaps are addressed by the nexus community
	Illustrating land-use changes as a major factor of climate change	Translate research results into policy measures
SIM4NEXUS new partnerships	Establishing links between stakeholders from different sectors	Assess the long-term effects of cross-sectoral dialogue on work organisations and governance
	Contributing to the creation of a network of nexus researchers	Continue activities within the Nexus Projects Cluster

4 Giving shape to SIM4NEXUS Legacy

Efforts have been made by the SIM4NEXUS consortium for many months to “prepare for” the end of the project and to ensure the project’s ideas, tools, results and partnerships established during the project continue to be used, live and be active after June 2020. The following paragraphs summarises some of the main features and focus of these activities.

We first describe how our target audiences have been engaged in our activities to ensure legacy of the project. We then demonstrate the impacts from the SIM4NEXUS project.

4.1 How to target relevant audiences for SIM4NEXUS legacy?

SIM4NEXUS has mobilised, and has been in touch with, a wide range of stakeholders throughout the project implementation. In particular: (a) the research community beyond SIM4NEXUS, including via the role of the project in the [Nexus Project Cluster](#); (b) public decision makers and stakeholders contributing to policy making development and implementation at different scales; (c) teachers and students from universities/learning institutions; (d) some representatives from the private sectors,(depending on case studies and via work carried out by Strane as part of the development of the project exploitation strategy.

Note that the project, and the different products it has delivered, do not target the general public, citizens or consumers. Professionals from the urban sector (urban planners e.g.) or individual professionals (e.g. farmers) are also not a direct target group (while farmers’ representatives are – as part of stakeholders mentioned above), although some of the messages and recommendations developed can be relevant to their sector.

4.1.1 Projects partnerships & research communities

SIM4NEXUS has established many links and synergies with the research community to share knowledge and resources, including via the publication of research articles which list is presented in [Deliverable D7.7](#) (to be finalised in June 2020).

SIM4NEXUS has influenced research teams both within the partners’ organizations or in fellow institutions.

The project took advantage of the internal newsletters, poster sessions⁴ or events organized by the **partners organizations** to add the nexus to the event ‘s agenda, to disseminate SIM4NEXUS results and to spark new initiatives. As an example:

- SIM4NEXUS was well represented during the International Conference ‘[Water Science for Impact](#)’, which was held at Campus of Wageningen University & Research on 16-18 October, 2018. The ‘water-energy-food-ecosystem nexus’ was one of the three themes of the conference. Five partners (WUR-LEI, UNEXE/SWW, PBL, DHI and UNESCO-IHE) attended and contributed to the event. Several presentations were made on policy coherence and the Nexus, on the results of the case study in South West UK and on the on-going work on System

⁴ See for instance from WUR-LEI : <https://www.SIM4NEXUS.eu/userfiles/Deliverables/Poster%20Linderhof%20-%20How%20to%20achieve%20a%20low-carbon%20economy%20for%20the%20NL-final.pdf>

Dynamics Modelling. SIM4NEXUS had also its own session entitled 'Policy coherence and the nexus concept; learning from Serious Games'.

SIM4NEXUS did join **existing projects Clusters, platforms or teams** such as :

- The nexus Network and its conference [Sustainability in turbulent times](#).
- [The Joint Research Center](#) (JRC)'s WEFE project (Water-Energy-Food-Ecosystems Nexus: Analysing solutions for securing supply). The goal of the JRC WEFE nexus project to help the design and implementation of European policies that are dependent on water in order to identify areas for EU policy convergence, coordination and integration. By combining expertise and data from across the JRC, the WEFE-Nexus project provides support to several Commission DGs, informing cross-sectoral policymaking on how to improve the resilience of water-using sectors such as energy, agriculture and ecosystems. A joint workshop associating SIM4NEXUS and the JRC WEFE nexus was held in Ispra, associating staff members from JRC and different partners from SIM4NEXUS. The workshop stressed the importance of data sharing as a relevant topic for further collaboration.
- The [CRUNCH](#) project : Climate Resilient Urban nexus CHOICES: operationalising the Food-Water-Energy nexus [2017-2021]
- The collaborative platform [climatechangemitigation.eu](#). The website aims to sum-up research and results of EU projects working on climate change mitigation. It supports development of low-emission pathways for reaching the goals of the Paris Agreement, including research on low-emission technology development and diffusion, policy making and governance, as well as institutional aspects of adopting low-emission solutions. This portal is an initiative from the current Dialogue on European Decarbonisation Strategies ([DEEDS](#)).
- [ICT4Water](#) (Gabriel Anzaldi (Eurecat) and Lydia Vamvakieridou (KWR/UNEXE) are part of the management team). SIM4NEXUS partners participated in its annual events, SIM4NEXUS been identified as a front-runner and initiative falling within the planned activities of this cluster. SIM4NEXUS discussed steps towards the development of cross-domain data sharing mechanisms for the water-energy-food-land-climate Nexus. SIM4NEXUS Partners offered to lead several groups such as Action Group on Data Sharing (WUR-LEI and UTH) or Action Group on Interoperability and Standardisation (Eurecat).
- [Water4Cities](#): Holistic Surface Water and Groundwater Management for Sustainable Cities
- The Energy Consultants Centres Network ([EKIS](#))

SIM4NEXUS Partners are also members of the External Advisory Boards of other Nexus-related initiatives such as [MAGIC](#) (Floor Brouwer, WUR-LEI) or [Future Earth](#) (Chrysi Laspidou, UTH).

New partnerships or collaborations have also stemmed from SIM4NEXUS, such as the joint DHI / UNEXE PhD proposals on machine learning and AI tools.

4.1.2 Communities of practitioners & economic sectors

Central to the SIM4NEXUS approach was the engagement of communities to ensure sustainable interest and demand in the different outputs the project was developing and delivered. A wide range of stakeholders participated in the mobilisation activities developed in the 12 case studies, the complete list of stakeholders involved is available in [Deliverable D5.5](#).

Although rather marginally in terms of total number of persons, SIM4NEXUS managed to engage stakeholders that are rarely associated in nexus studies – or who do not feel concerned by nexus issues though they are crossing over all 5 nexus domains. As example : the banking sector; insurance companies; representatives of the tourism sector; landscape architects and designers.

The longevity of the relations built during SIM4NEXUS among stakeholders will be assessed by KPI n°5 before the project ends.

4.1.3 Students and young professionals

Enhancing the nexus literacy of future professionals has been central to the philosophy of SIM4NEXUS since the start of the project.

SIM4NEXUS has organized summer schools to teach about the Nexus. And preliminary versions of the Serious Game had also been tested with different groups of students in different countries.

- IHE-Delft organized a Summer Course '[Sustainable development in the water-energy-food nexus](#)' in 2019. The objective of the course was to be able to identify how nexus science and systems thinking is useful in everyday professional activities. The 25 students attending (25 in total) showed interest in the national and regional case studies that address global societal challenges.
- IHE-Delft also played the Serious Game at [IMT Atlantique](#) (France), as part of a the Masters' program.
- BEF-Latvia organized 2 Serious Game testing with university students in Latvia and Lithuania
- The Free University VU Amsterdam held a Summer School 'Food and Water Security: Challenges and Innovations', for Advanced Bachelor and Master students. WUR-LEI organized a 4 hours' session entitled 'Understanding interactions between water, energy, land and food resources (SIM4NEXUS Serious Game)'. The course material included a detailed introduction to the game with a guide to familiarize with the game environment and content, and guiding questions to explore and play the game. The Serious Game for Greece clearly shows the challenge of climate mitigation for 2030 and beyond. Some groups were able to considerably improve the nexus Health related to climate dimension. It was observed water and land policies may require efforts early on. This gives proof of evidence that targeted policies (e.g. land and water) are essential to reach a high nexus health score.
- Strane organized different serious game test sessions in France with students as well as professionals from the industry (in relation to their activities on the exploitation strategy). Feedbacks and outputs from these training sessions are detailed in the [Deliverable D6.5](#).
- Additional training sessions with students using the Serious Game are being organized in France, Germany and Switzerland (ACTeon).

Master students or PhD students involved with SIM4NEXUS research activities participated to the dissemination of SIM4NEXUS results in their Universities while presenting their thesis. This includes Universities which are not members of the consortium, such as VU University Amsterdam. A number of lectures on the nexus were also organized by SIM4NEXUS Partners and more are planned in the coming years. The various examples from SIM4NEXUS (be it the knowledge from the case studies' territories or the project's tools) are used by the partners involved with education and teaching, especially for MSc level.

4.1.4 Bringing institutions and decision makers on board

Experts from local authorities, regional services, national administration... were involved in the different stakeholder mobilisation events organised in the different case studies (apart for the European and Global case studies that did follow a different process).

SIM4NEXUS did attend the "[Local Mayors and Communities Exhibition](#)" in 2019 to showcase the Serious Game. These 3 days clearly showed the increasing popularity from all type of audience for

serious gaming. Feedbacks from the visitors and participants (NGO, industrials, some public bodies) had been very encouraging and sparked the nexus Business Groups facilitated by Strane.

4.2 Which impacts – tangible or expected?

The following paragraphs capture some of the key impacts of the SIM4NEXUS project – some having already materialized while other are only now becoming visible. The impacts are organized according to the PLACARD framework, from “soft legacy” inspiration (4.2.1), to embeddedness (4.2.2) and “hard legacy” institutionalization (4.2.3).

4.2.1 Providing inspiration

4.2.1.1 To stakeholders

Each 12 case studies of SIM4NEXUS organized workshops with selected stakeholders to contribute to the project’s development. These workshops were an opportunity to **raise people’s awareness** on the nexus issues on their territories and the dependencies across natural resources and economic sectors.

The trainings that are now planned under the Exploitation activities will continue the work and draw attention to the synergies and trade-offs among sectoral policies. Note that this first awareness raising on the issues and challenges of the nexus did not deliver (yet) specific requests for research and consultancy support for addressing the nexus in relation to the strategies and policies they have responsibility for.

4.2.1.2 To policy-makers and policy-advocates

SIM4NEXUS has also published 5 Policy Briefs (as of March 2020) to raise awareness on the nexus issues and sustainable solutions **among policy makers at European level**.

1. [COHERENCE IN EU POLICY ON WATER, LAND, ENERGY, FOOD AND CLIMATE](#) (Munaretto, 2017)
2. [POLICY COHERENCE OF THE EU COMMON AGRICULTURAL POLICY WITHIN THE nexus BETWEEN WATER, ENERGY, LAND, FOOD AND CLIMATE DEPENDS ON POLICY IMPLEMENTATION](#) (Witmer, 2019)
3. [IMPLEMENTATION OF EU WATER POLICIES MAY BENEFIT FROM SYNERGIES WITHIN THE nexus BETWEEN WATER, ENERGY, LAND, FOOD AND CLIMATE](#) (Witmer, 2019)
4. [SIM4NEXUS 8 POLICY COHERENCE RECOMMENDATIONS TO THE EUROPEAN GREEN DEAL](#) (Witmer, 2020)
5. [LANDSCAPE RESTORATION TO MITIGATE AND ADAPT TO CLIMATE CHANGE](#) (Pokorny, 2020)

Other policy briefs are planned before the project ends to translate the SIM4NEXUS results.

4.2.1.3 To the research community

SIM4NEXUS inspired also **other researchers and practitioners** through the broadcasting of its results and approaches via established international or national arenas. Here are a few examples.

Bringing the nexus to the Water community

- SIM4NEXUS partners attended the [EU Water conference](#) in Vienna on 20-21 September, 2018. At the event, there was a specific session on agriculture, and the European Commission’s post-2020 CAP proposal raised a number of discussion questions with the public. Water utilities raised their concerns on increased agricultural pollution of drinking water sources and the additional costs for treatment before drinking, as well as on the gap of implementing the polluter-pays-principle. SIM4NEXUS partner Fresh Thoughts provided input into a back-to-

back NGO workshop, to identify synergies and conflicts between the CAP in the present 2014-2020 period and the WFD implementation, as well as to improve coherence between the policies in the post-2020 period.

- SIM4NEXUS participated in [Water Innovation Europe](#) (WIE) editions, each time offering speeches (University of Exeter presenting the Serious Game to 50 persons), attending group discussions (to discuss the outline of a policy brief on the water-energy-food nexus) or moderating panel discussions ('Interlinkages between water and energy services' moderated by WUR-LEI, with panelists from the IEA International Energy Agency, AMS-Institute and ENGIE Laborelec. It is an important platform for knowledge and business partners to meet and share innovations in the water sector.
- SIM4Nexus demonstrated the first version of the Greek Serious Game at the [International Water Week](#) in Amsterdam (sept. 2019)
- SIM4NEXUS is involved in the nexus Working Group since June 2016 and participates to the [Water Knowledge Europe](#) events to discuss the WEF nexus in a circular and a low-carbon economy.

SIM4NEXUS was also present at :

- The [Budapest Water Summit](#), organized by the International Secretariat for Water and Solidarity Water Europe;
- The International Workshop : [Digital Water and Nature based solutions](#) of the LIFE REWAT project;
- The [European Water Tech Week](#),
- The [EIP Water conference 2019](#), including a presentation by Maria Witmer (PBL) on the European Green Deal and the Nexus.
- The [Waterwise](#) conferences.

Finally, SIM4NEXUS Partners are involved in Water-related projects where they can bring the nexus knowledge : e.g. Fresh Thoughts is a member of the External Advisory Board of the H2020 project [LOTUS-India](#) and task leader in the DRyVER project on water scarcity in river networks. Knowledge from SIM4NEXUS will also be valued through two contracts with the European Commission DG ENV, namely the European Innovation Partnership on Water, and the Support to International water cooperation. The nexus science and the Serious Game developed within SIM4NEXUS will be shared through the [watershare](#) network, led by KWR, dedicated to developing knowledge and science-based tools for addressing water challenges.

Bringing the nexus to the Climate community

- SIM4NEXUS was present at the COP23 in Bonn (2017) and contributed to the [COP24 in Katowice](#) (2018) by hosting the session in UNFCCC Pavilion "The Paris Agreement and the nexus of Water, Energy and Food: Policy Coherence and Serious Games". WUR-LEI introduced 'A nexus approach for climate action', UTH gave a speech on 'Nexus policies through serious games' and UNU-EHS presented 'Sustainable Development Goals and global environmental change'. Some 40 participants were very much interested to learn about the process of implementing case studies, and the participants expressed great interest in the game part of the Nexus. SIM4NEXUS also organized a side-event in the EU Pavilion titled 'Climate action, land and the Nexus'. Some 30 people participated and we received compliments regarding the stakeholder interaction we launched at the start of the project.

- SIM4NEXUS attended [ECCA2019](#), the European Climate Adaptation Conference, held in Lisbon, 28-30 May 2019. Partner WUR-LEI presented ‘The nexus concept for a resource efficient Europe; co-benefits of climate mitigation and adaptation measures’. Lessons-learnt from the conference were shared with the SIM4NEXUS consortium regarding recent results on the development and application of new approaches for serious gaming, decision-support tools, products and services for climate adaptation, including their relevance and efficacy in supporting learning, raising awareness and promoting action.
- SIM4NEXUS Partners are involved in Climate-related projects where they can bring the nexus knowledge: e.g. Fresh Thoughts is a member of the External Advisory Board of the ERA4CS project [INNOVA](#).

Bringing the nexus to the Energy community

- SIM4NEXUS participated in the meeting of the Energy Modelling Platform for Europe 2018 ([EMP-E 2018](#)): “Modelling clean energy pathways”. It contributed to the session on ‘Integrated modelling of energy and resource efficiency’ and presented ‘The nexus concept for a resource efficient Europe: challenges for energy modelling’.

Bringing the nexus to the Food community

- SIM4NEXUS was invited at [FACCE SURPLUS](#) (sustainable and resilient agriculture for food and non-food systems) [workshop on valorization](#) (2019). The participants discussed ways to use the scientific results, distinguishing between testing technologies (close to market), resilient solutions and proof-of-concept that remain to be tested for entering commercial marketing. SIM4NEXUS was presented as an example, introducing the Serious Game and contributing to the debate on the ‘valley of death’ (describing the gap between academic-based innovations and their commercial application in the marketplace).
- SIM4NEXUS Partners are involved with the [AgMIP initiative](#) where improvements on the thematic models as well as the nexus approach are valued.

Bringing the nexus to the Land community

- SIM4NEXUS participated in the Advancing Earth and Space Science ([AGU](#)) events as well as the European Geoscience Union ([EGU](#)) events.

The Exploitation phase of SIM4NEXUS will largely be dedicated to publications and scientific conferences to continue the dissemination of results towards the research community.

4.2.2 Embedding the nexus into our research thinking and practice

4.2.2.1 Internal trainings

Trainings for project partners on the nexus and on the use of the Serious Game have been organised by KWR, to ensure that they have the **capacity to further use and disseminate the SIM4NEXUS tools**. A first training session was held on April 23rd 2020 (Serious Game for Azerbaijan) and others are planned based on the Serious Games for Greece (May 13th) and Latvia.

The Exploitation strategy of SIM4NEXUS relies a lot on nexus trainings, using the serious game, to empower the local stakeholders.

4.2.2.2 Modelling capacity

SIM4NEXUS has contributed to new **developments in existing (thematic) models** in addition to the development of the SDM. For instance, the OSeMOSYS model now includes Azerbaijan⁵, as a result from the case study activities led by KTH, and energy data from E3ME model on Azerbaijan could be included within OSeMOSYS as input. For what concerns the OSeMOSYS Global CLEWs model, the project also allowed the Land sector of the model to be improved. SIM4NEXUS has contributed to the improvement of the “2°C scenario” (scenario including the objectives from the Paris agreement to cap the rise of temperatures to a maximum of 2°C compared to pre-industrial levels) in the E3ME model. New datasets could also be integrated in the models: IMAGE-GLOBIO expanded its datasets on water quantity and water quality, for instance. The thematic model [MAGPIE evolved into its version 4](#) thanks to SIM4NEXUS.

In addition, it has contributed to strengthening the modelling capacity of some partners, via a better understanding of how the other models are structured and can be connected. The facilitation of these discussions was established through the Global case study, which is the only case study requiring model runs from all thematic models.

Apart from thematic models, SIM4NEXUS also **improved the visualisation tools** at DHI, Eurecat and University of Exeter, which will benefit other research, education or consultancy activities.

4.2.2.3 Data access / Data sharing

SIM4NEXUS data management has been established and updated in [Deliverable D3.2](#).

SIM4NEXUS-SPACE facilitates data access

SIM4NEXUS had to cope with several data challenges:

- Different data sources (local, national and continental) are used in our modelling tools and 12 case studies,
- Intellectual Property Rights (IPR) issues
- Delays of the release of public data
- Some components have insufficient level of integration and automation
- Available GIS technologies are not utilized to the full extent possible.

These challenges are referred to in SIM4Nexus Data Management Plan ([Deliverable D4.7](#)).

EPSILON has proposed a way to overcome and address these challenges by developing a new extended approach within SIM4NEXUS building upon, replacing, and enhancing the current technologies in the project. SIM4NEXUS-SPACE has the following objectives:

- Replace SIM4NEXUS input datasets with data from publicly available databases, including (a) Satellite data (e.g. COPERNICUS, Landsat) which have sufficient spatial and temporal resolution to cover the needs of SIM4NEXUS, (b) thematic data (e.g. COPERNICUS, EUROSTAT)
- Take advantage of state-of-the-art GIS technologies, standards, libraries and techniques, which allow (a) better utilization and processing of available datasets, (b) translate parameters into thematic layers, and (c) standardise data sharing through well-established data formats and protocols enabling integration with other GIS platforms.
- Automation of the process, and cross-validation of findings with current results in SIM4NEXUS.

The development of SIM4NEXUS-SPACE sets the ground for new collaborations and applications, further details are provided through [Deliverable D6.3](#) or the website : <https://sim4nexus-space.eu/>. The database is accessible online and maintained by EPSILON Malta.

⁵ Scientific publication is still pending (submission planned in summer 2020)

Case studies published datasets

The Greek case study has published its data at the Mendeley data repository (the DOI is : <http://dx.doi.org/10.17632/9x7wn24rrp.1>.)

The project plans for the open access release of all data from SDM, and is seeking confirmation by consortium partners (at the time of writing).

SIM4NEXUS shares lessons learnt with DG CONNECT

SIM4NEXUS did attend the DG CONNECT workshop on creating a common European data space for environmental and climate-related data. Our data-related work in SIM4NEXUS and in the ICT4WATER cluster (lead by Floor Brouwer – WUR-LEI and Chrysi Laspidou – UTH) were shared during the morning-session of this workshop addressing the kind of data that are mostly needed by environmental innovators and the challenges faced when using this data. The workshop was well attended (around 60 participants) and will support the development of common European data spaces, available through the new Digital Europe Program.

Additional contacts with European Commission DGs are planned at the end of the project to present the wealth of results and products.

4.2.2.4 Transferability / Replicability

A “water-energy-food nexus toolkit (WEF-Tools) to support sustainable and inclusive socio-economic development in water scarce regions” and funded by [DUPC2](#), a cooperation between IHE Delft and the Dutch Ministry of Foreign Affairs, has been launched and is underway. As part of this project, some of the knowledge, experiences and expertise of SIM4NEXUS will be transferred to an African context, with case studies in the southern African region, and the Middle-East-North-Africa region. In some cases, work from SIM4NEXUS will be used as guidance and illustration to support WEF-Tools activities.

Other options to transfer or replicate SIM4NEXUS tools and frameworks are being investigated, such as **follow-up research projects** (applications on-going with PRIMA, COST or H2020 funding).

4.2.3 Bringing nexus results to policy making

Via its research activities, and thanks to the interactions established with policy making stakeholders at different scales, SIM4NEXUS has been able to bring the nexus concept, challenges and solutions in decision making in a few cases, contributing (even if in a very modest level) to the internalization of this concept in the thinking of some institutions.

4.2.3.1 Development of policies

The development of the Regional Strategy for Adaptation to Climate Change (SRACC) of Sardinia (IT) was supported by SIM4NEXUS results

The Strategy activated an inclusive governance process based on a multi-sectoral approach and is a key factor in shaping the adaptation process. The development of the SRACC generated bidirectional synergies with the SIM4NEXUS Sardinian case study that provided models and processed data for in-depth analyses at municipality level for some sectors strongly influenced by climate change. Indeed, the nexus approach applied in Sardinia allowed an analysis of the complex system dominated by interactions and feedbacks among the water, land, food, energy, and climate sector. In particular, the SRACC contains in-depth information on the hydrogeological structure and risks of the territory, the agricultural and forestry sectors, the inland water sector with implications of water governances for multiple sectors, such as agriculture, domestic and tourism. For the latter, and in particular inland water agricultural and forestry, the analyses of vulnerability and risk were carried out by University of Sassari and UN-IHE through their involvement in the SIM4NEXUS project, and by the Euro-Mediterranean Center on Climate Change which also developed the climatic analysis up to 2050. The

collaboration with the development of the SRACC also opened new opportunities in terms of stakeholder involvement and interaction as well as an improved knowledge of the functioning and management of relevant sectors in Sardinia.

SIM4NEXUS results used to support the Regional County of South Bohemia (CZ)

SIM4NEXUS results on the role of land cover and vegetation in:

- carbon sequestration;
- damping of temperature extremes by evapotranspiration of water;

are used to support the Regional County of South Bohemia (Czech Republic). The contract is aimed at restoration of water regime in agriculture landscape and is based on collaboration between the counties of East Slovakia and South Bohemia/Czechia. Really effective impulse for the collaboration was the International meeting of stakeholders of the transboundary Germany – Czech R. – Slovakia case study, in May 2019 in High Tatra. The transboundary case study impact on regional policies is described further in [SIM4NEXUS 5th Policy Brief](#).

Other case studies leaders are involved in **on-going policy processes** (WUR-LEI and PBL on biomass policy debates in the Netherlands, ACTeon on regional planning policy with Grand Est Region in France, etc.), though results have not yet been published.

4.2.3.2 Contributing to further application of SIM4NEXUS products

To support further use of the tools and products delivered, including by seizing potential market opportunities, SIM4NEXUS partners (lead by Strane) have developed a dedicated **SIM4NEXUS exploitation strategy** (see upcoming [Deliverable D6.3](#)). This strategy focuses on 2 main items which are:

- The serious game and its use for trainings on the nexus science and policy making

The SIM4Nexus Serious Game is freely accessible through the web : <https://seriousgame.sim4nexus.eu/sim4nexus-LoginPage.html>

Two countries can be played : Azerbaijan (the “easy” mode”) and Greece (the “advanced” mode). As work is ongoing on the other case studies (Latvia, The Netherlands, South-West UK), the web-platform is maintained and regularly improved.

Some Partners have already developed training sessions based on the games : KWR organized [a special session](#) during the Dresden Nexus Conference (June 3-5, 2020) with a participation of 70 people.

- Maintaining and updating the user interface, the KEE, the models and the databases (with possible interactions with the SIM4NEXUS-Space).

A visualisation tool for the rich databases of the Global case study has been developed and is made freely accessible through : <https://seriousgame.sim4nexus.eu/global/#> This offers an easy way to understand the relations between the Nexus components based on real datasets and model outputs. The tool can be used by anyone interested in experimenting the Nexus. A guided tour allows the user to understand the figures and links displayed.

SIM4NEXUS-Space is under development with Epsilon-Malta in the lead.

The exploitation strategy that aims at reaching different communities of students, decision makers and stakeholders will be launched with a two years’ trial period, with partners involved remaining open to opportunities that might emerge to exploit other products of the SIM4NEXUS project. The steering group of the Exploitation Strategy is composed of WUR LEI, KWR and UTH.

5 Conclusions and recommendations

SIM4NEXUS has early on taken action to ensure a strong legacy of its results and products. The idea of an exploitation of its successful tools was already there during the project's design. The communication strategy – during the project's lifetime – and the partners efforts to advertise the project are basic steps towards a legacy. In addition, the WP6 partners have evaluated the feasibility of exploitation of SIM4NEXUS products and designed the exploitation strategy which describes activities to be performed over the years following the projects' end. Other individual initiatives by the project's partners also contribute to the project's legacy. The legacy report takes in all these activities and adds recommendations to strengthen them.

SIM4NEXUS has achieved a lot. The Partners identified a list of 21 added-values covering tools, frameworks, processes, knowledge, partnerships or concepts, both in “hard” sciences (models, computer science e.g.) and “soft” sciences (policy, social science, e.g.). Significant progress has been made for the nexus community: SIM4NEXUS contributed to the evolution of the concept, to the development of dedicated interfaces and visuals, and identified remaining gaps to be covered by future research. The scientific community as a whole has gained knowledge, extensive datasets, improved modelling capacity and new frameworks. The stakeholders and decision-makers involved in SIM4NEXUS case studies also benefited from the project through participation to cross-sectoral events, gaining a better understanding of the synergies and trade-offs between sectors, visualising the impacts of policy choices. SIM4NEXUS also supported the identification of innovations and policy instruments to achieve resource efficiency for each case study. Finally, the education community will now be able to use a wide range of case studies examples as well as serious games to teach about the nexus, about natural resources use, or policy development.

SIM4NEXUS has taken the necessary actions to start to inspire / embed / institutionalise the outcomes of the project. However, much remains to be done in the years following the project's termination in June 2020. Through the Nexus Project Cluster and many other research initiatives and partnerships, the SIM4NEXUS consortium has created the right links to pass-on knowledge, experiences but also new challenges. The project partners have been empowered – through the multidisciplinary work, case studies comparisons, methodological guidance and trainings, offered all along the project's lifetime. It covered stakeholder engagement, policy assessment, data collection, modelling or using a serious game (among others). They will now be able to use, replicate, improve and extend the SIM4NEXUS outputs.

6 Appendix A: Minutes of the exploitation working groups for SIM4NEXUS

04/07/2019 – workshop organised and animated by ACTeon & Strane Innovation

Introduction

The purpose of this document is to present the working groups formed during the exploitation workshop of SIM4NEXUS on Thursday the 4th July 2019 during the project meeting in Riga.

4 working groups have been constituted:

- EDUCATION
- POLICY TRANSFER
- SERIOUS GAME
- REPLICATION AND POLICY INTEGRATION

More activities based on the results of the projects could be possibly added afterwards.

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6.1 Education

Description & Target group(s)	<ul style="list-style-type: none"> • Opportunities to include SIM4NEXUS in courses over the next years. • Target audience: BSc, MSc, PhD • Open audience lectures - apply for sessions • Target audience: Open, academia • Development training material across different education levels • Target audience: • High level education • Teachers and Teacher trainees • Training material on the game • SUMMER SCHOOL (2020, deadline in October, Radboud). • Target audience: BSc, MSc, PhD, also professionals • MOOC - Online Course • Training on practical solutions for the nexus. • Target audience: Civil society, retired people
Partners (including lead(s))	<ul style="list-style-type: none"> • University of Exeter • UTH • IHE • Radboud University Bioeconomy (Master Course) • KTH - Energy & Environment (BSc).
Preparatory activities	<ul style="list-style-type: none"> • Identify partners interested in the development of the materials and assignments • Guest lecturers • Prepare basic materials and teaching materials

Type of exploitation	<ul style="list-style-type: none"> • High-level education, universities within the consortium • For profit and/or non-profit. Option of development schools (1- 4 weeks), share the revenues, fees as high as you like (150€ /student profit; fee is around 400€/week and does not include accommodation, includes lunch and coffee break) • Free and/or payed
Timing/milestones	<ul style="list-style-type: none"> • Timeframe for next academic year (2020)

Table 1: Description of the activities for the education workshop

6.2 Policy Transfer

Description & Target group(s)	<p><u>Policy transfer possible at two scales:</u></p> <ul style="list-style-type: none"> • 1st scale (global) European or national level • 2nd scale (local) Regional or communities or major companies • Directives and legislation from the EU/national level will influence the regional/communities/companies' level (from global to local scale). • Good practices from the regional/communities/companies' level can be mainstreamed into wider scale policies (from local to global). • It works both ways. <p><u>Policy transfer is about:</u></p> <ul style="list-style-type: none"> • The nexus approach (which requires to describe how this approach is different / complementary to “policy coherence”, “integrated management”, “risk-based approach”, “sustainable development”) • The policy recommendations stemming from the case studies • Our ways of working (case studies, trans-disciplinarily, evidence-based, 2050 projections, stakeholder’s engagement, policy scenarios, ...) <p><u>Some examples:</u></p> <ul style="list-style-type: none"> • What is the difference between SDGs and the nexus approach: this should be clarified under S4N • Improve the Horizon Europe (FP9) contents done, the nexus Project Cluster contributed to the consultation on Horizon Europe • Aqueduct Water Risk Atlas (developed by WRI: https://www.wri.org/our-work/project/aqueduct) or the Water Risk Filter (developed by WWF: https://waterriskfilter.panda.org/) are risk-based approach platforms and only focusing on Water. They are very successful with companies, NGOs and governments. à how to make these more Nexus-oriented? “Manifesto” has been produced by other H2020 projects to contribute to several policy processes
Partners (including lead(s))	<p><u>Leader: not FT, not ACTeon</u></p> <ul style="list-style-type: none"> • Involve SIM4NEXUS partners: PBL, UNU, KTH, Water Europe • Make it a part of the Nexus Projects Cluster (NPC) • The NPC allows to reach a critical mass to gather interest. • Examples of the NPC activities: • Glossary will be promoted • Handbook on the Nexus
Preparatory activities	<ul style="list-style-type: none"> • Critical mass to attract interest (a “SIM4NEXUS manifesto” is not impactful, a “Nexus Cluster manifesto” is better)

	Funds? Maybe enough from the involved projects. Need calculate what are the necessary costs to carry-out activities.
Type of exploitation	<ul style="list-style-type: none"> • This activity is not commercial, not part of exploitation, this is legacy. • It could someday be a CSA (coordination and support activity) for the EU Commission = coordination tasks for multiple projects on nexus issues. EU has first to identify there is a need for a CSA on the Nexus. It would be in parallel to JRC role, need check if they see the nexus as relevant topic.
Timing/milestones	<ul style="list-style-type: none"> • Talk to PBL, UNU, KTH, Water Europe about it and revise ambition + roadmap with them • Talk within the nexus Projects Cluster • Identify other allies / partners such as JRC ... or even GIZ (they own the nexus Platform: clarify our relations) • Increase involvement into policy processes (Directives being revised, new Horizon Europe funds, regional policy development) • Achieve impact through final SIM4NEXUS conference

Table 2: Description of the activities for the policy transfer workshop

6.3 Serious Game

Description	<ul style="list-style-type: none"> • Product: Exploitation of the Serious Game. • Service: educational purposes, use by stakeholders • Target Groups: water utilities, NGOs, banks, policy groups, students, academics, other researchers, JRC, municipalities, gamers • Duration: From 1 hour to 1/2 day • Frequency: on demand Location: online or local workshops <p>Organization of the activity:</p> <ul style="list-style-type: none"> • A coordinator (it may be virtual or a video) is needed to lead the game session <p>Some kind of performance evaluation (form, KPI or whatever) to evaluate the learning of players.</p>
Target group(s)	<ul style="list-style-type: none"> • Water • Utilities • NGOs • Banks • Policy groups • Students • Academics and other researchers • JRC • Municipalities • Gamers
Partners (including lead(s))	<ul style="list-style-type: none"> • University of Exeter (potential leader) • Partners interested: • Eurecat, DHI, Epsilon, WUR-LEI, Water Europe
Preparatory activities	<ul style="list-style-type: none"> • We need spin-off, organization or something similar to run the activities • We need some roles: Administrator, accounting, administrative, salesman,

	<ul style="list-style-type: none"> • We need the outcomes of SIM4NEXUS project (12 case studies) • IPR agreement • We need a little office • We need computation infrastructure • from 100€/month to 2.000€/month depending on the users <p>Developer support (another role)</p>
Type of exploitation	<ul style="list-style-type: none"> • Commercial
Timing/milestones	<ol style="list-style-type: none"> 1. Decide products and services, and at which price have to offered. Market Analysis 2. Get confirmation from interested partners, considering potential investment 3. Reach for IPR agreement 4. Decide legal form of the entity, and in which country (or countries).

Table 3: Description of the activities for the serious game workshop

6.4 Replication and policy integration

Description	<p>The service is a consultancy service that aims at supporting policy changes (objectives, principles, instruments...) that enhance policy coherence. It builds on:</p> <ul style="list-style-type: none"> • An overall framework for analyzing current policies and identifying areas of friction/policy incoherence • Tools (complex modelling & serious game) that structure and organize complexity and help capturing (direct and indirect) connections/links between system's components • A stakeholder process that aims at mobilizing stakeholders from different sectors for « working together » • Overall guidelines for supporting policy coherence <p>There are two types of services that can be offered: the first one aims at raising awareness and help « nexus like thinking »; the second aims at supporting the identification and evaluation of policy options that aim at enhancing policy coherence.</p>
Target group(s)	<p>Public authorities at the regional, national and EU scale –in charge of a given sector or responsible overall for the allocation of public financing</p> <p>Public and private operators in the field of water</p> <p>Business/private (large) companies</p>
Partners (including lead(s))	<p>WUR (including its business development unit) & ACTeon (consultancy)</p> <p>University partners of SIM4NEXUS (from Greece, likely others?) ready to contribute in terms of content but not to lead</p>
Preparatory activities	<p>The following preparatory activities have been identified – without clearly specifying who to lead and timing.</p> <ul style="list-style-type: none"> • Develop guidelines for policy coherence/shift to nexus thinking–building on all outputs of SIM4NEXUS (lead partners?) • Make efforts to be visible by potential clients/target groups, e.g. policy makers at regional/national/European scales (all partners?)

	<ul style="list-style-type: none"> • Further developing the service and present it in an information note– including examples from different case studies stressing the added-value of the service (lead partners) • Identify opportunities for the service (specific steps in policy development – e.g. the development or renewal of a strategy, a new planning cycle starting...) that could be supported by the service (all partners for their own country)
Type of exploitation	Commercial potentially (workshop not discussed in more details)
Timing/milestones	Not discussed, to be specified by the lead partners as the road map develops

Table 4 : Description of the activities for the workshop on replication and policy integration

7 Appendix B. Outcome of the brainstorming session on SIM4NEXUS added values

Strengthening our (scientific & institutional) capacity to address NEXUS/to help people to understand complexity in a NEXUS context	1
Supporting a change of mind - from disconnected (silos) to integrated thinking	2
Bringing the NEXUS concept higher on the agenda/in people's mind - making inter-sectoral impacts more explicit	3
Serious games and visualisation tools for training and for communicating a complex issue in a simple manner	4
Help strengthening communication between stakeholders from different sectors	5
SDM that will allow opportunities to further investigate policy impacts on different sectors	6
Learn what are the gaps in knowledge - in bringing the different sectors together	7
Learning about the limitations about the SIM4NEXUS approach	8
Playing policies in time - see the long-term implications, give attention to policy dynamics	9
Strengthening communication between NEXUS communities - learning to understand the language of other disciplines, building a common language	10
Building a network of NEXUS researchers	11
Finding links between sectors/making them more explicit	12
How can social approach and modelling be best combined to strengthen the emergence of "best NEXUS solutions"	13
Insight into the strengths and weaknesses of "NEXUS" collaboration	14
Demonstrating the variability of case studies with regards to NEXUS issues and challenges	15
A commitment for exploitation and use of the legacy	16

Table 5. List of added-values and ranking – group 1

Awareness of the Nexus concept and Nexus word	1
Policy coherence among nexus-related policies identified conflicts and synergies, contributing to a roadmap for future	2
Data collection from different databases and organisations on a monthly timestep up to 2050, for all case studies	3
Stakeholders start thinking in a holistic way : take into consideration other Nexus sectors (awareness)	4
SDM : transform qualitative knowledge into quantitative analysis	5
SDM : map data and allows you to test endless scenarios	6
Organise the thinking towards less and better consumption (efficiency) : logical + quantitative	7
Quantification of policies into parameters to be included in SDM and SG	8
Define a methodology combining technologies towards a multi-criteria analysis	9
Interaction between the scientists and the politicians / decision-makers	10
Nexus Performance Indicators : helped visualise the complexity of interactions in user-friendly way	11
We found ways to present highly complex results : through the SG or other visuals and make it accessible	12
Land-use changes as major factors of climate change was illustrated	13
Learned more to work interdisciplinary and include social science : we included policies in quantitative science (models)	14
Combination of policy cards, NPI, SDM, ... integrated in AI tools, to implement intelligent agents and manage the Nexus	15
Diversity of CS problematics -> better Nexus thinking	16
Overview of success factors for Nexus policy making -> to adapt the policy process to a Nexus-thinking	17
Limits of the models and data availability : combination of all the data collected and several models closed the gap	18
Not integrated planning (for instance in drinking or waste-water) -> more integrated now	19
We learned of how different organisation work : those aiming at publishing, policy-making processes, practical results	20
We applied Nilsson's score for policy coherence to all case studies : translation from EU to regional	21
The SG as part of the daily routine, at least among us, and tomorrow for the stakeholders	22

Table 6. List of added-values and ranking – group 2