



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

D6.1: DRAFT EXPLOITATION STRATEGY

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ADDRESSING REVIEWERS' GENERAL COMMENTS

COMMENT

RESPONSE

General content

The report contains much unnecessary information concerning, for example, development status updates, explanations about open access and open data, which detracts from the core exploitation strategy content of the report.

Recommendation: To remove unnecessary information.

All the unnecessary information related to IP explanations such as open access and open data as well as the description of the different types of exploitation (non-profit organisation, description of foundation...) have been removed.

IP

It is not made clear who is coordinating the innovation aspects (including IP and exploitation) of this collaborative project. It is noted (p43) that partners are *“strongly encouraged to give their feedback on all the partners/owners of the data and outputs produced, and to consult their respective legal department to determine what would be the management strategy of their intellectual property generated in the project.”*

Whilst it is appropriate to analyse IP ownership, the IP Management is not clearly explained and mainly related to dissemination, not exploitation. In particular, it is not made clear (a) who will manage and host the IP and data needed to deliver the SG and the consultancy service; (b) the proposed terms of access and use of all needed IP; and (c) arrangements between joint owners.

In addition, the report contains (P50) encouragement to partners to declare their individual exploitation strategies for their results. This does not recognise the collaborative nature of the project, nor address the expected impacts of the call. It also introduces many complications concerning use and management of the IP.

Recommendation: It is recommended that there is clear innovation management (including IP and exploitation) at consortium level. There should be a definitive statement made concerning overall management responsibility, the IP status and strategy at consortium level, and its management for the purpose of exploitation to achieve the expected impacts. In particular, the availability is secured for the necessary background, 3rd party and project IP, as well as any other key resources needed to provide and support the proposed consultancy and SG.

IP management has been clarified and stated in section 4.2 in accordance of what has been stated in the Grant Agreement (§ 1.3.4 and §3.3). The Innovation management has been described based on the Grant Agreement clauses.

Exploitation

Several exploitation options are proposed, all valid to some extent, but proposed to be run sequentially, when in fact they are all complementary and should be in parallel. They cover dissemination of the project results; the serious game; and consultancy services. This fragmentation introduces unnecessary complexity and fails to generate any common identity or sustainable entity.

The exploitation strategy has been completely modified given an unified strategy in only one structure (Non-Profit organisation) integrating the activities of Serious Game and consulting. The overall strategy clarifies the complexity of the exploitation and suppress the fragmentation former strategy. It would help to deal with the IP complexity with the creation of a Scientific

Individually each element is not convincing as an exploitation option, but together they can be seen as complementary business streams. The dissemination activity (which can be combined with general promotional activity) to raise awareness (at a cost) and the serious game (small revenue), both have the objective of commissioning high value consultancy. All this done within one organisation would enable a critical mass to be built, as well as brand value. In addition, combining these streams would be more likely to attract funding/ donations/ investments, and benefit from shared resources (e.g. finance, marketing, infrastructure, etc).

Recommendation: It is recommended that the consortium consider a simplified consolidated, rather than a fragmented, exploitation strategy, perhaps based around a new for-profit company. This company would then conclude agreements for access and use of all needed IP with the relevant owners. Agreements can be reached with key personnel for their time on consultancy and other company projects as required.

Open source

Whilst there should be open access for research publications and research data, making available other information free of charge (e.g. scenarios and case study data, conceptual models, and the Serious Game in open source) should be reviewed, since this will potentially have an impact on commercial exploitation of both the game and consultancy services, by reducing competitiveness and diluting the brand. If an Open Source approach for software is adopted, then it should be fully justified, including how the community of developers will be managed and sustained after the end of the project to avoid forks.

Recommendation: Consideration should be given to the costs and benefits of making certain information freely available, particularly if it might impact commercial exploitation, and if so justified.

Board where the partners can continue to work and develop the nexus knowledge and product and services.

Different options of exploiting the Serious Game taking into account the requirement of the European Commission have been proposed in this report:

- A free trial version of the serious Game (open access on the website) displaying a basic features, case studies and policy cards. This will be a teaser for the complete version
- A full licensed version with paid access that would display the complete set-up of the Serious Game. Paid training sessions could accompany the handling and comprehension of the game.

These propositions should avoid the reduction of competitiveness spotted by the reviewers.

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Glossary / Acronyms

As the document is being written, terms and glossary will be added here as needed. Before the last version is submitted this list will be re-arranged alphabetically by the lead author.

ABM	Agent Based Module
AE	Analytical Engine
API	Application Programming Interface
CM	Coordination Module
CS	Case Study
DSS	Decision Support System
GLOBIO	GLOBal Integrated assessment mOdel
GTAP	Global Trade Analysis Project
GUI	Graphical User Interface
IE	Inference Engines
IPR	Intellectual Property Rights
JOA	Joint Ownership Agreement
KEE	Knowledge Elicitation Engine
MS	Milestone
NGO	Non-Governmental Organization
NHI	National Hydrological Instrument
NPI	Nexus Performance Indicators
NPO	Non-Profit Organisation
PM	Person-Month
R&D	Research and Development
SME	Small and Medium sized Enterprise
SG	Serious Game
SR	Semantic Repository
WP	Work Package
WS API	Web Service Application Programming Interface

Executive summary

Changes with respect to the DoA

No changes with respect to the DoA.

Dissemination and uptake

The deliverable is for public diffusion.

Short Summary of results (<250 words)

This report assesses the current technical and IP status of the SIM4NEXUS project. All components are mapped, and the complex interactions among them which characterize the SIM4NEXUS project is analyzed, in particular in the light of intellectual property.

The report proposes a draft exploitation strategy to be discussed among the project partners. A combined for-profit and Non-Profit exploitation is recommended to ensure the largest project impact, making the best of commercial exploitation of the System Dynamic Models, the Knowledge Elicitation Engine and the Serious Game, and of wide dissemination of the Nexus knowledge accumulated by the project.

One exploitation route is recommended: a **Non-Profit organization** (NPO) should be established, ideally as a **foundation** which can closely interact with existing to set a large network around the Nexus theme, that the Nexus Business Group could prototype before the project end, and include the **Serious Game** that should be exploited commercially inside the Non-Profit organization.

The **consultancy** to offer Nexus risk assessment based on the Nexus scenarios developed by advanced SDMs that was explored in previous report is abandoned as this option is non commercially viable.

Creating a new business (either as a new startup or a new spinoff in an existing organization) is very challenging and subject to many risks. The proposed action plan focuses on de-risking the main questions regarding the SDMs, the IP strategy to be followed, and the teams who are to take responsibility for their exploitation after the project end.

Evidence of accomplishment

This report is the evidence of Deliverable D6.1.

Draft Exploitation Strategy of SIM4NEXUS project

1 Overview progress

Task 6.3: Definition of commercial products and services and of the associated exploitation strategies	
Task leader: STRANE	Involved: UTH, EURECAT, DHI, EPSILON (M12-M30)
<p>One of the goals of task T6.3 is to define the exploitation strategy of the SIM4NEXUS project to propose the best valorisation path for all the results. Different, feasible draft exploitation plan is proposed in this report which is delivered in the correct timing (Month 30).</p> <p>The draft exploitation strategy and related action plan proposed in this report will be discussed at the Month 30 meeting and the subsequent activities will be organised following the decisions taken by the consortium. The next milestone is the Go/No Go milestone at Month 36 (MS27) to pursue the realisation of the exploitation routes concretely.</p> <p>This deliverable (D6.1) summarises the market assessment and the competition (presented in the Deliverable D6.3 at M12), an analysis of the technical and IP status as of November 2018, building on the partners' feedbacks on the MS23 report submitted in September 2018, a mapping of exploitable principles by component, an overall exploitation strategy and some details on the exploitation route proposed.</p> <p>Overall WP6 is on track. No risk of deviation has been identified so far.</p>	

2 Introduction

The SIM4NEXUS project has many strengths:

- A complete study of 5 Nexus components is a very first in the world
- A very strong academic value (leading-edge research), at a time where academic interest is high and emerging. Exploitation is therefore highly innovative, and market is new.
- A wide network of partners within academia, private companies, public institutions that are potential influencers and clients for SIM4NEXUS
- 10 diverse case studies representative of most singularities in Europe, (land use, climate, geology, soils, etc.), 1 in Asia and 1 global case study modelling the world entirely, making SIM4NEXUS widely
- The SDM versions developed in SIM4NEXUS are adapted to various applications: training and/or awareness raising purpose as well as modelling and expert consulting.

The project also faces key challenges:

- SIM4NEXUS results are highly inter-related, so finding a proper exploitation is very challenging
- The research activities are still ongoing, and results are still being produced and updated; yet the technical maturity is still low so many potential applications remain hypothetical.

This “draft exploitation strategy” aims to

- Assess the technical and IP status of the SIM4NEXUS results
- Propose an overall strategy based on a combined for-profit and Non-Profit exploitation
- Describe the recommended exploitation routes
- List the main exploitation risks identified so far
- Suggest an action plan to be discussed at the Month 30 meeting

The information in this report is based on:

- The results from the draft market study (D6.3) delivered in May 2017
- The report submitted in September 2018 for MS23 on potential product/services, and the feedbacks from project partners
- Bilateral discussions with Leaders of WP3, WP4 and WP5, and many partners, in particular case study leaders, thematic models’ developers and technical providers

The deliverable 6.1 is structured as follows:

- **Section 3** presents the mapping of the components of the SIM4NEXUS project (including describing the overall technical architecture (components, the involvement of all partners in all case studies and assesses the required effort to replicate the SDMs) , Case study material and the assessment of SIM4NEXUS outputs. The information is an update of the MS23 report submitted in September 2018 based on partners’ feedbacks. This section describes also the Nexus Business Group (NBG) set up as T6.2 to provide a link between the scientific research and the needs of the market and private companies.
- **Section 4** addresses Innovation management principles governing SIM4NEXUS, in accordance with the requirements of the European Commission. It provides a – draft – list of IP holders by key component, to be verified by ALL partners.

- **Section 5** provides a detailed exploitation strategy listing the potential different options envisaged and focusing on the business model and business plan of a Non-Profit Organisation (NPO) as the most impactful strategy for SIM4NEXUS
- **Section 6** synthesizes all findings

This draft exploitation strategy has been updated after discussing informally with different partners at the Month 30 meeting in Exeter and takes into account the remarks and feedbacks of the Project review 2.

3 Mapping of the components of the project

3.1 SIM4NEXUS overall technical architecture

The project is built on intricate components realized by different partners to understand and visualise the interactions between the 5 Nexus parameters (Water, Energy, Climate, Food & Land) on every case study. Figure 1 depicts a simplified vision of the systems and exploitation routes described in this document.

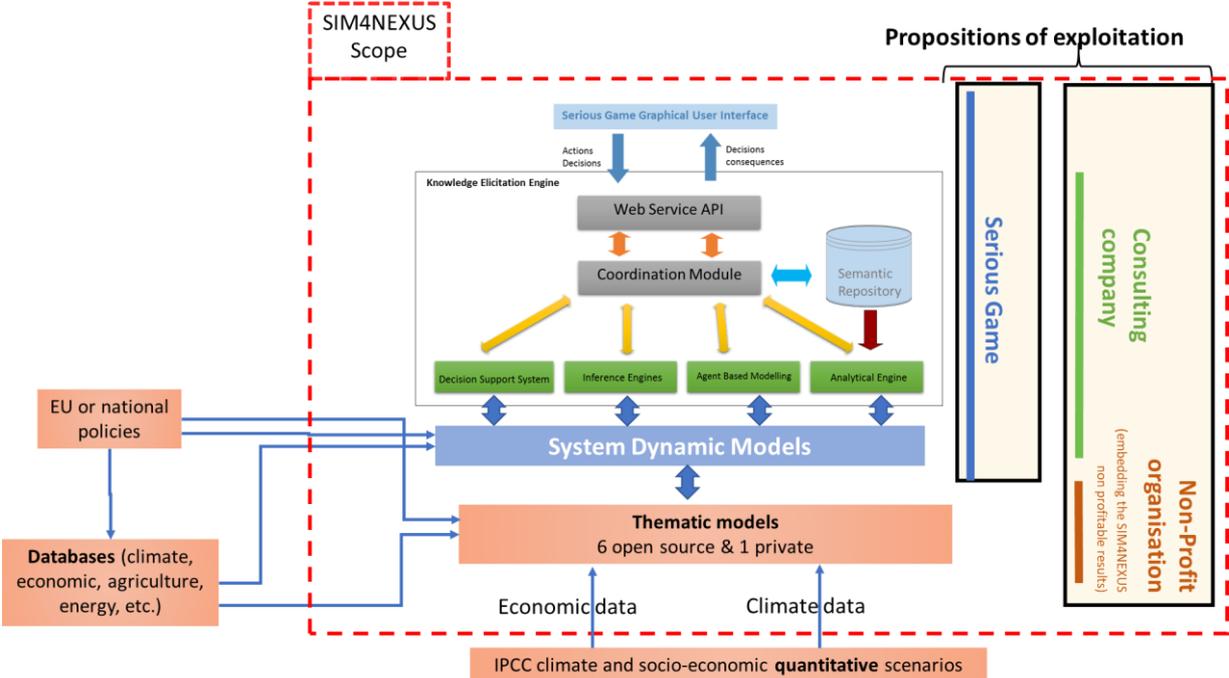


Figure 1: Global schematic representation of the SIM4NEXUS architecture and the possibilities of exploitation (source: adapted from EURECAT)¹

SG GUI

At the top of the solution schema there is the Serious Game Graphic User Interface, which allows the users to interact with the system, where they can take different decisions and actions, and understand the consequences of the actions performed through the game status changes after each step.

Knowledge Elicitation Engine

In the next layer, there is the Knowledge Elicitation Engine (KEE), the core of the system, which englobes the Web Service API (WS), the Login system, the Coordination Module (CM), the Semantic Repository (SR), the Decision Support System (DSS), the Inference Engines (IE), the Agent Based Modelling (ABM) and the Analytical Engine (AE).

¹ Source: Description given by EURECAT

The table 1 shows the modules of the KEE and their description. The third column shows how the modules of the KEE communicates one with each other.

Modules of the KEE	Description	Communication with other modules
Semantic Repository (SR)	The SR is divided into two parts: 1) a visual interface to explore semantic data and create a catalogue, 2) An ontology that categories Nexus variables and game knowledge (user selections, system results, etc.). The SR is also used to learn and create virtual players (ABM).	ABM, IE
Web Service API (WS API)	The WS API is a web service that runs a translated into Python version of the SDM code and enables it to be run from everywhere while the SG is running.	AE
Analytical Engine (AE)	The AE compute and process the input and output data from/to the SDM (inside the WSAPI)	WS API, DSS
Decision Support System (DSS)	The DSS provides alert, advice, simulate virtual players with ABM. The DSS also indicates what policies should be applied in the game to reach the scenario goals.	AE, IE, ABM
Agent Based Module (ABM)	Based on the knowledge of the SR, the ABM creates virtual agent for the game.	SR, DSS
Inference Engines (IE)	The IE analyses scenarios, validates proposition depending on already accepted propositions, uses Machine Learning to create knowledge from data of the SR, stores information in the SR.	SR, DSS
Coordination Module (CM)	The CM connects modules with each other. It is more a general concept like a broker.	WS API, SR, AE, DSS, ABM, IE

Table 1: Description and interrelations between the different modules of the Knowledge Elicitation Engine

The KEE is implemented by EURECAT and EPSILON. The KEE takes as input the SDM of each case study. Each information provided by the thematic models is stored in the Semantic Repository. When the KEE needs to understand which the consequences of applying policies to the current scenario status are, it runs the SDM with the corresponding input parameters.

Once the KEE has done every calculation for the SG, the KEE feeds the Serious Game Graphic User Interface in order to display the new scenario status in the Serious Game.

In each Game step, the KEE takes as an input the User actions/decisions and the Game status, and process this information through the SDMs and Game logic to obtain the next Game status. The actions/decisions correspond to i) the Interventions selected ii) and the Interventions cancelled by the Users in each step. The Game status corresponds to the current i) Game turn, ii) applied or cancelled Interventions, and iii) SDM stocks.

Web server API

The Web Service API provides the communication between the SG UI and the KEE, dealing with all the requests and responses, and interacting with the Semantic repository storing them. In the following layer, the Coordination Module manages all the logic in the system and monitors all the infrastructure status. The Semantic Repository works as a knowledge base, where the generated data is stored following the defined ontology, allowing the Analytical Engine to be able to learn from these data through machine learning algorithms. The Decision Support System provides recommendations and feedback to users in each step of the SG. Finally, the Agent Based Modelling implements intelligent software agents, based on the acquired knowledge.

Nexus Integration system

The bottom layer of the schema is the Nexus Integration, which provides the system with the basic Nexus knowledge to operate with, based on the Thematic Models, through the SDM Engine.

SIM4NEXUS has set up 12 Case Studies at regional, national, trans-national, European and global levels. All Case Studies follow the same methodology to create a System Dynamic Model (SDM) of the interrelation of the different components of the Nexus (Water, Energy, Climate, Food, Land).

Different versions of the SDM are developed by each case study in accordance with their priorities (economy, geography, Soil-Climate, installations, industry, agriculture level and diversity, trade, politics, etc.). They validate every interconnection with expert stakeholders and run their SDM by taking data from various sources (databases, climate scenarios, thematic models). Once every case study SDM is set up, the plan is to aggregate all of them in the KEE Engine (to which the Serious Game is connected) to generate games and scenarios and provide their corresponding options (i.e. policies) at each turn.

3.2 SIM4NEXUS case study material

3.2.1 General description

All the components of the elaboration of SDM are represented in the following figure:

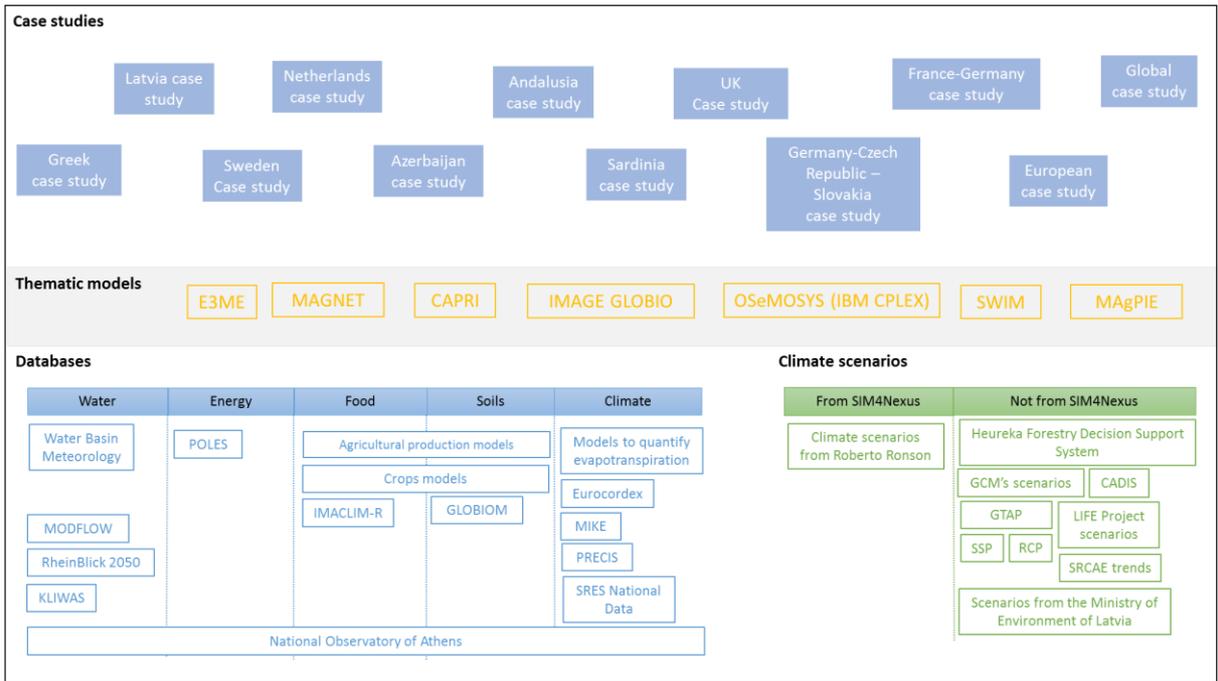


Figure 2: Architecture of component involved in the creation of the SDM

The starting point of the SIM4NEXUS project is the creation of System Dynamic Models by each of the 12 Case Studies (**3 regional**: Andalusia, UK, Sardinia; **5 national**: Greece, Latvia, Sweden, Netherlands, Azerbaijan; **2 transnational**: France-Germany, Germany-Czech Republic-Slovakia; **1 European** and **1 global**).

Each case study defines the main Nexus components related to their area. Every case study is unique and depends on the region/country, the soil-climate conditions, the industrial and agricultural setup, the trade (import/export especially in Energy, food, water), energy mix available, availability of water resources, use of land, number of habitants, touristic areas, etc. This step of the Case Study definition includes the participation of stakeholders of the Case Study.

Using the software Stella, each Case Study has built its own SDM by modelling the interrelationships between all the parameters inside their scope with the help of scientific reviews, governmental data and stakeholders' advices.

SDM have computed the links between the different parameters. Data and scenarios from the following sources were fed either in the thematic models used to feed the SDM:

- ❖ **15 databases** (some are specialized in one of the Nexus domains, some are cross-domains (see figure 2))
- ❖ **9 climate scenarios** (Life Project Scenario, Scenario from ministry of Latvia, SSP, RCP, National Public Scenario (Delta), GCM, GTAP, CADIS, SR CAE Trends)
- ❖ **7 thematic models** (E3ME, MAGNET, CAPRI, IMAGE GLOBIO, OSeMOSYS, SWIM, MAgPIE)

The data of the thematic models enable to populate the parameters required by the System Dynamic Model at each time step (5 years, with possible variations, based on EURECAT assumptions) over a long period of time (20, 30 or 50 years).

Figure 2 shows that there are lots of components involved for the creation of the Case Study/SDM. It demonstrates the complexity of the project especially when it comes to the IPR issues and the exploitation. The interrelations between each case study and the Thematic Models, databases and climate scenarios will be detailed and analysed in a specific section 4 "Description of Case Studies".

3.2.2 Specific description for each case study

The table 2 summarises for each case study:

- The Thematic Models, databases and climate scenarios used to setup their SDM
- The main Nexus components that are covered in the SDM
- The objectives of the Case Study in particular as regards the benefits for their stakeholders.
- The expected functionalities of the Serious Game, with some suggestions for improvement by DHI.

This information has been gathered from the posters of each case study presented during the Kick-off meeting (07/2016), the deliverable D5.1 "*Common application and evaluation framework for SIM4NEXUS Tools*" for the listing of all the databases used for each Case study (29/11/2016) and the interviews conducted by WP5 (ACTéon, WUR-LEI) during May 2018 concerning: "*Addressing the NEXUS issues in each case study – Progress and interaction between work packages*".

After the first drafts of the serious game, the Case Studies have put forward the following ideas and remarks for Serious Game's improvement. The following ideas and remarks are extracted from the interviews with the case study leads made by WUR-LEI and ACTéon ("Addressing the NEXUS issues in each case study – Progress and interaction between work-packages"). The most updated version at the time of writing were the ones of the 05/2018. Most recent interview of each case study is summarized in the following document:

- i) SIM4NEXUS-Case-studies-questionnaire_France-Germany for the CS France-Germany
- ii) SIM4NEXUS-Case-studies-questionnaire_AND for the CS Andalusia
- iii) SIM4NEXUS-Case-studies-questionnaire_AZ for the CS Azerbaijan
- iv) SIM4NEXUS-Case-studies-questionnaire_DECZSK for the CS Deutschland-Czech-Republic-Slovakia
- v) SIM4NEXUS-Case-studies-questionnaire_EU for the European CS
- vi) SIM4NEXUS-Case-studies-questionnaire_Global case for the Global CS
- vii) SIM4NEXUS-Case-studies-questionnaire_Greece for the Greek CS
- viii) SIM4NEXUS-Case-studies-questionnaire_Latvia for the Latvian CS
- ix) SIM4NEXUS-Case-studies-questionnaire_NL for the Dutch CS
- x) SIM4NEXUS-Case-studies-questionnaire_Sardinia for the Sardinian CS
- xi) SIM4NEXUS-Case-studies-questionnaire_SE for the Swedish CS
- xii) SIM4NEXUS-Case-studies-questionnaire_UK for the UK CS

the document "Addressing the NEXUS issues in each case study – Progress and interaction between work packages" of SIM4NEXUS and are summarize. Below are the major improvements suggested by the Work Package Leaders in the interviews of the 05/2018 as follow:

Concerning the use of the thematic models by the Case studies, the information between the table displayed in the D5.1 in 2016 and the interviews of the Case studies leader in May 2018 have shown some differences of the thematic models used. Some are no longer used for the elaboration of the Case study. We have chosen to put the latest information in the table 2 below to reflect more accurately the mapping of the case studies. Also, Strane Innovation asked each case study to check the information presented in the scheme number 3 to 14. The necessary modifications could be made by Strane Innovation also as the updates of each case study.



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

Case study number	Partners	Thematic models used	Databases and climate scenarios used	Main Nexus Components	Objectives	Serious Game and expected functionalities
1 – Greek	University of Thessaly Cambridge Econometrics, Wageningen Research, UPM, PBL, KTH, National Observatory of Athens	E3ME, CAPRI OSeMOSYS	Water data and waste water data, Energy data by municipality, Crop data & Livestock, Crop Water requirement, Land uses, Climatic, data, Touristic Data, LIFE project scenarios	Water resource efficiency (tourism & agriculture), Sustainable food production (land use), Low-carbon energy transitions & climate change adaptation	Give a tool to end users (SWS, regional water authorities, PASEGES) to manage water and wastewater policies and manage water, energy and land use for agricultural yield.	Constraints might be introduced (e.g. amount of GHG, flood) for policies analysis. Events can be case- specific
2 – Latvia	Baltic Environmental Forum Cambridge Econometrics, UPM, Ministry of Environment of Latvia	E3ME MAGNET CAPRI	Scenarios from the Ministry of Environment of Latvia	Energy production (biomass production), Water, food and climate (in context of climate change) Energy policies (impact on water, air, biodiversity, land use and climate change)	Use of Serious Game by authorities at local/regional/national level to influence sustainable utilization of biomass in the country.	Management of events to be implemented in the Serious Game (e.g. flood) Game might introduce artificial currency (related to purpose of the game (welfare, resource efficiency)) which might be an indicator of performance of the player
3 – Sweden	Uppsala University Swedish University of Agricultural Sciences, Cambridge Econometrics, Wageningen Research, UPM, PBL, PIK, IPCC	E3ME, MAGNET, CAPRI, IMAGE-GLOBIO	HYPE, RCP, SSP,	Climate change mitigation and adaptation for agriculture, water, forestry and land use	Influence stakeholders and shape of government policy regarding forestry, agriculture and energy. Possible target group for SG (answers of stakeholder survey): 44% for students; 31% for others (researcher, public agencies); 25% for decision makers; 0% for business/companies	

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

Case study number	Partners	Thematic models used	Databases and climate scenarios used	Main Nexus Components	Objectives	Serious Game and expected functionalities
4 – Netherlands	Wageningen Research, Netherlands Environmental Assessment Agency, Cambridge Econometrics, UPM, PBL, PIK, IPCC	E3ME MAGNET CAPRI	NHI, Agricultural production models, FADN RCP, SSP, National Public Scenario	Transition to low Carbon economy Climate mitigation and adaption Agriculture: Nutrient recovery / Sewage / manure processing circular economy	Serious Game relevant for comparable regions helping to give broad insight and in-depth analysis. Learn about Nexus issues, raise awareness and offer possibility to test policies. Make decision national level markers (Ministries, researchers, NGO, Private companies) play the SG with interest in carbon free economy, renewable energies, biomass production	Serious Game is quite complex (Nexus Dimensions, economics, policies etc.). SG should include option to select the SSP and RCP to play with. Business as Usual (BaU) is the reference situation but this is not fun playing with this setting. Need an option to change parameters in the Game to fit and be coherent with player's interventions or political choices Multiplayer option would be an asset (though not high priority) SG should not simply be a nice interface to display SDM results
5 – Azerbaijan	KTH, UPM, Cambridge Econometrics, Wageningen Research	E3ME MAGNET CAPRI OSeMOSYS	Water Basin Meteorology RCP, SSP,	Energy (oil production and export with use of water, land use and GHG emissions) Agriculture (Water, crop adaptation and reforestation)	Give end-user insights and help designing policy for shift from an oil base economy to a more sustainable pattern (based on renewable and what are implications for agriculture and water management) Use the SG for students and then operators and only last policy makers as part of educational project	Need to ask directly the players how to make the game more engaging by putting some constraints from modelling and/or policies team as they know better major limitations Use the SG on Chrome navigator. Should be accessible online

Case study number	Partners	Thematic models used	Databases and climate scenarios used	Main Nexus Components	Objectives	Serious Game and expected functionalities
6 – Andalusia	Department of Agricultural Econometrics, UPM	E3ME MAGNET CAPRI	CAPRI database, national and regional databases, SSP, RCP	Land and water (urbanization and farming intensification), exploitation of water resources, inadequate water saving technologies and energy use . Agricultural and environmental policies for: water management, climate change mitigation and renewable energy .	Use the outputs and Serious Game by regional agriculture, water and energy institutions related to policy making . Target: policy makers, decision makers, NGOs and research organisations .	Allow access to more information (datasets, parameters) to some participants Instead of giving fictional money , it would be more realistic that player has a fixed amount to allocate among different policies in consideration of government shift.
7 – Sardinia	Regional Water Authorities, Regional Ministry of the Environment, Agricultural Economics, UPM,	E3ME CAPRI	Crops models Models to quantify evapotranspiration, GCM's scenarios. GTAP, SSP, RCP	Agriculture (sustainable (local) food production Water provision (irrigation) Water quality (urban use and tourist sector) Climate change Energy sources (renewables) and GHG	Use the result of policies analysis as framework guide towards a low carbon society and adaptation plans to climate change: reduce hydrological risks, halt the biodiversity, sustainable tourism, agricultural sector / water criticalities (end-user: regional government)	Preference for multiplayers but single players with different roles is worth as well. Need to be realistic for support decision making: random introduction of unexpected events (floods, droughts, crises). Insertion of thresholds . Including budget for policy costs (low, medium, High) Put resource efficiency indicator
8 – United Kingdom	SWW, U of Exeter, Centre for Water System, Energy Policy Group, Cambridge econometrics, UPM	E3ME CAPRI	CADIS, GTAP	Agriculture (sustainable food production) Water and wastewater services (resilience to climate change, population growth and need for increased reliance on renewable energy sources and reduced GHG)	SWW (end user) will use outputs and serious Game related to policies to influence land use management policies (extreme weather sensitive (flood, soil erosion)) Target: UK policy makers and regulators (such as DEFRA,	Need to deliver different levels of complexity and one realistic level. Introduce unforeseen events in a statistical event with a probabilistic happening

Case study number	Partners	Thematic models used	Databases and climate scenarios used	Main Nexus Components	Objectives	Serious Game and expected functionalities
					Environment Agency, OFGEM, OFWAT, local technical colleges, strategic business planning) Use of Serious Game in small workshop environments: support business planning which could potentially influence policies and private investments on water and energy. SG and SDM used as decision support tool to assist long term business planning within SWW	
9 – Germany/ Czech Republic/ Slovakia	Czech platform on sustainable Water resources Project Smart regions Commission for Innovation, PIK	E3ME CAPRI SWIM	Agricultural Production models Eurocordex, SSP, RCP,	Land – Water management practices Climate (implementation of natural water retention measures in forested, agricultural and urban landscapes)	Outputs and Serious Game related to policies for end users (municipalities, SME) to influence use management policies (especially in extreme weather event (resolve problems of flooding and soil erosion)). Target: policy makers, decision makers and operators to get feedback on commodities (water, energy) and then to raise awareness	SG not appealing Need to include random events . Include land management factor (including evaporation effect of lakes surrounding landscape Include transboundary relationships and NUTS region Player should choose policy instruments (like subsidies). SG does not need to be too technical
10 – France/ Germany	ACTéon, PIK, Cambridge Econometrics, UPM	E3ME CAPRI SWIM	RheinBlick 2050 KLIWAS, WISE POLES, IMACLIM-R Corine Land Cover, SRCAE trends	Climate + Biodiversity	Discuss issues on conflicts among Nexus sectors and how to address such conflicts with policy makers (Rhine-Meuse water agency) Policy makers are keen to better understand the implications of	The expected functionalities for the SG would be: - Map interface - Export results - Choose language - User guide

Case study number	Partners	Thematic models used	Databases and climate scenarios used	Main Nexus Components	Objectives	Serious Game and expected functionalities
					decision making across border (policies that create awareness and connect regions/actors)	- Etc.
11 – Europe	Cambridge Econometrics, LEI Wageningen, UPM, PBL, KTH,	E3ME MAGNET CAPRI IMAGE-GLOBIO MAGPIE-LPJML		Climate change Reduce consumption of fossil fuels Water demand Food security Biodiversity + interlinkages	There are three distinct target groups : 1/ Decision-makers = EU policy makers and their staff from the EU Commission. 2/ NGOs and policy influencers who wish to put forward some Nexus issues, spread their message. 3/ Education	To improve the engagement of players: add music and make sure the loading time is not too long . Unexpected events would be interesting to add and be able to choose the policy accordingly. As the SDM is not built to handle prices so might be difficult to include fictional currency . Need to add constraints on the number of policies that can be implemented by the player. Parameters grid is too complicated for new players → more for research or consultancy
12 – Global	Cambridge Econometrics, LEI Wageningen, UPM, KTH, PBL, PIK, IPCC	E3ME MAGNET CAPRI IMAGE-GLOBIO OSeMOSYS MAGPIE-LPJML	GTAP RCP, SSP	Global challenges (e.g. increasing food demand) and international trade features Policy priorities on 4 scenarios planned: (1) climate and energy ; (2) land use and terrestrial biodiversity ; and (3) water scarcity as well as	Use the outputs and Serious Game to support Nexus related policies (challenges) and to find broad-scale synergies and trade-offs between options in achieving various Sustainable Development Goals.	Add events : how to relate to SDM (underlying thematic models, scenarios planned and difficulties in identifying such events at global scales). SG responses are interpreted by 2 types of persons making

Case study number	Partners	Thematic models used	Databases and climate scenarios used	Main Nexus Components	Objectives	Serious Game and expected functionalities
				water quality. (4) combines all three targets simultaneously to explore synergies and trade-offs between Nexus domains	Target: DG CLIMA, DG ENV, IWC, Special Envoy for International Water Affairs (NL)	the laws and regulations: policy advisors and policy analysts. Introduce indicator which would make the game more interesting

Table 2: Description of the case studies

Each case study is unique in its concept and implementation (different databases, thematic models, Nexus component focus, and policy analysis) and covers all the 5 Nexus components but with specific focus (e.g. water/agriculture for UK, Land/water/climate for Trans DE-CZ-SK or energy/water for trans F-DE).

3.2.3 Partner involved in each case study

The results from the mapping of the interrelations of the different partners/thematic models and databases have already been reported in MS23 in September 2018. The versions were updated following the feedbacks from almost all the partners.

The versions proposed in this deliverable have all been reviewed by each case study.

The following figures (figure 3 to figure 14) depict the connections between each case study and the thematic models, databases and climate scenarios (highlighted in orange). The owners (whether SIM4NEXUS partner or not) of each data or model is listed in grey. When the owner is unknown, no name is associated with the database or the climate scenario.

Most of the figures have been verified and validated by the Case Study leaders associated and are marked as follow on the top left corner: Case studies while the ones that are still pending for a full validation and feedback from the Case Study leaders are marked Case studies (Latvia, UK, Trans boundary DE-CZ-SL and Global).

All information related to the ownerships of the databases/scenarios and the use of them for Case Studies has to be filled and validated by Month 36.

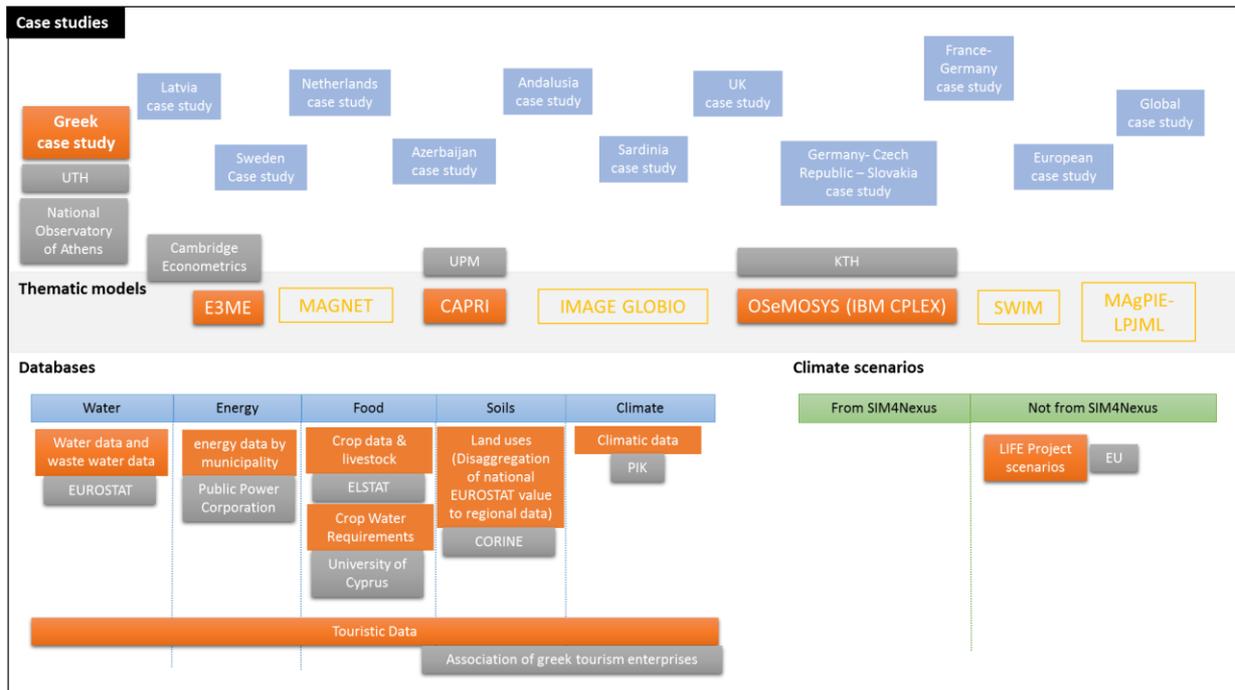


Figure 3: Map of the entities involved in the Greek case study

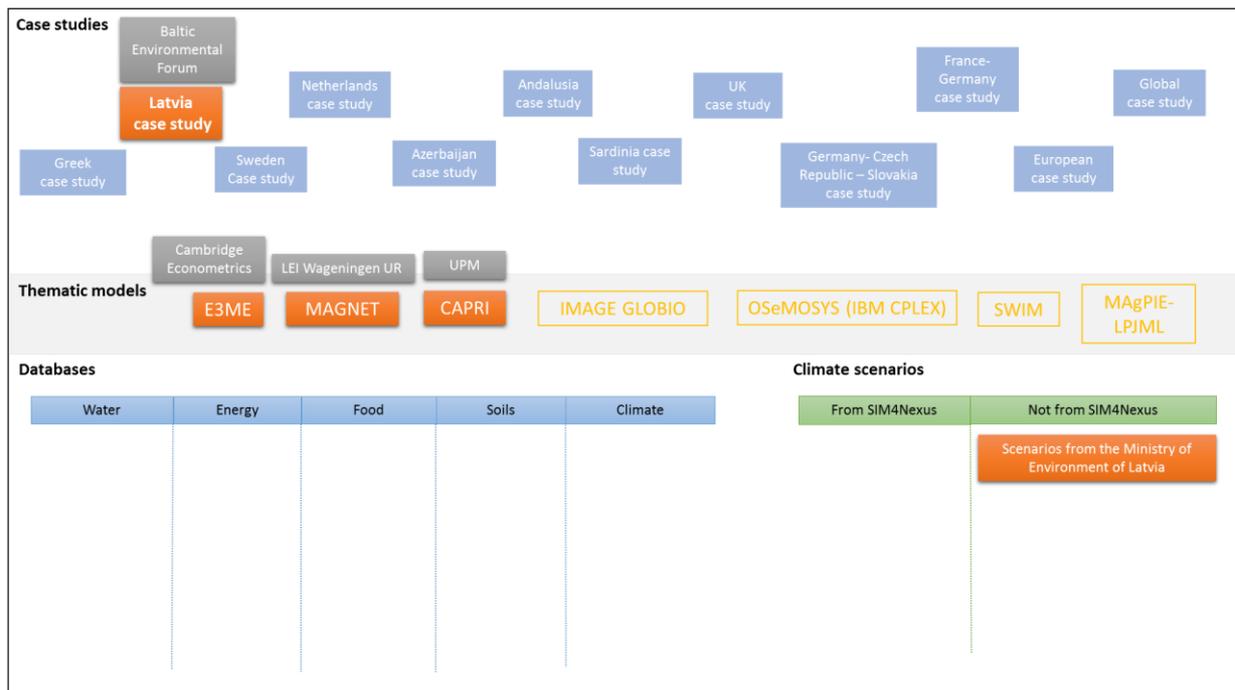


Figure 4: Map of the entities involved in the Latvian case study

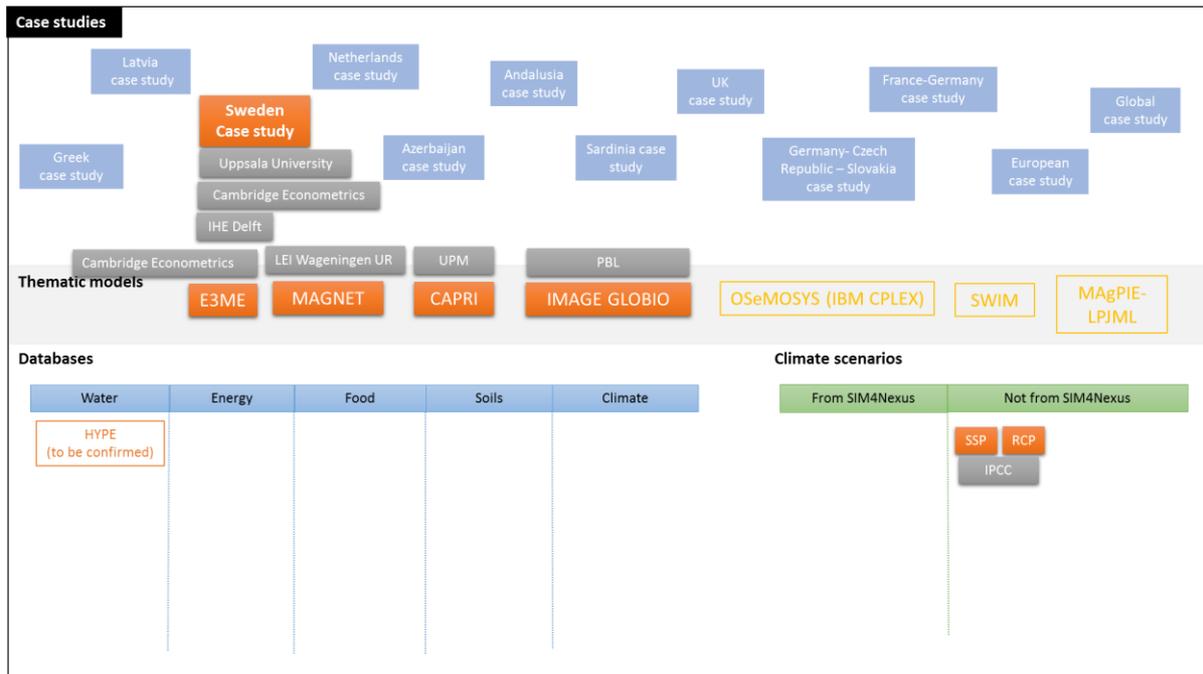


Figure 5: Map of the entities involved in the Swedish case study

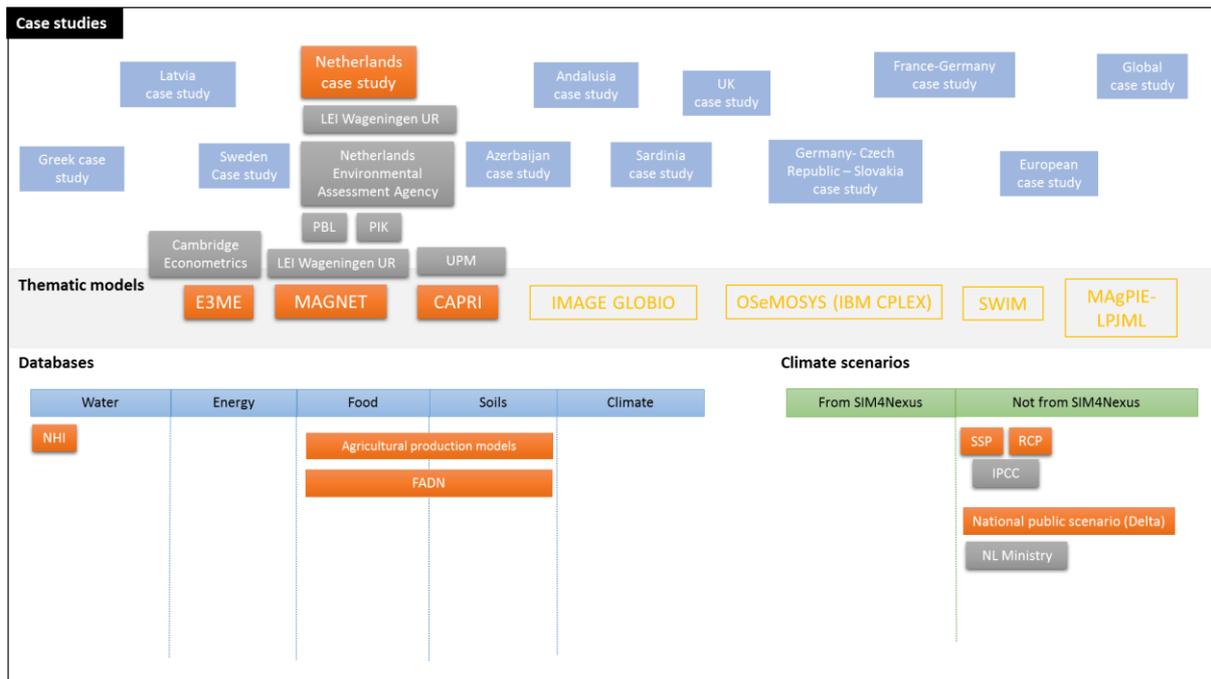


Figure 6: Map of the entities involved in the Dutch case study

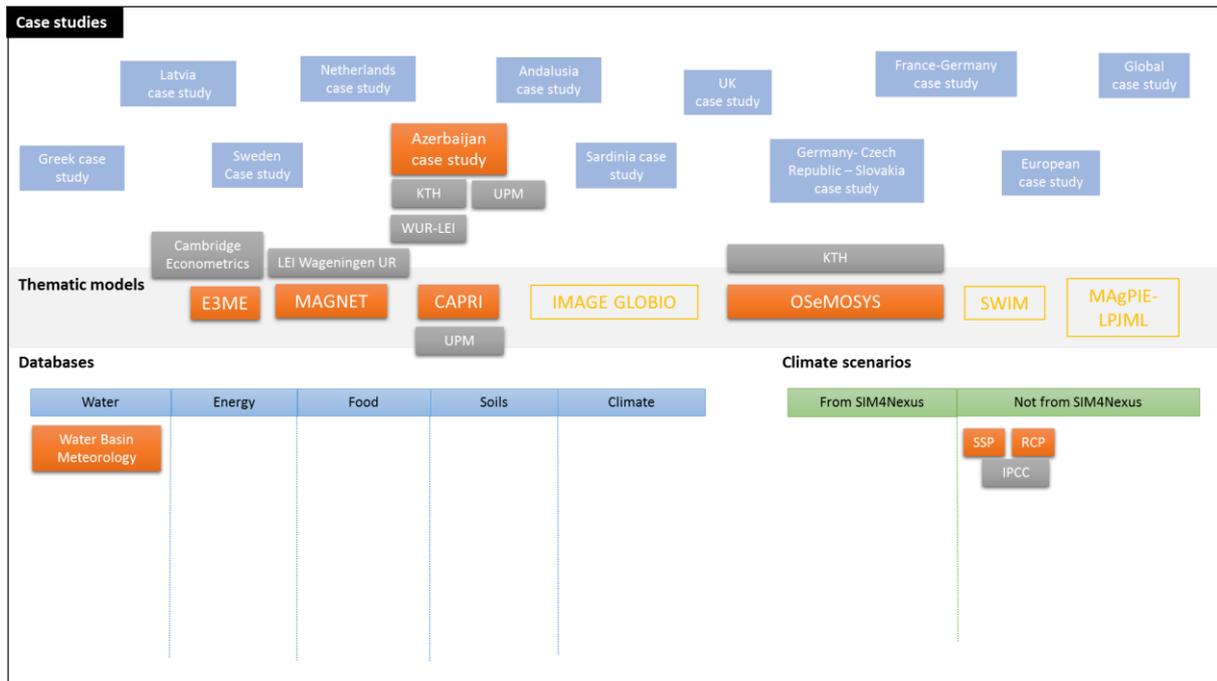


Figure 7: Map of the entities involved in the Azeri case study

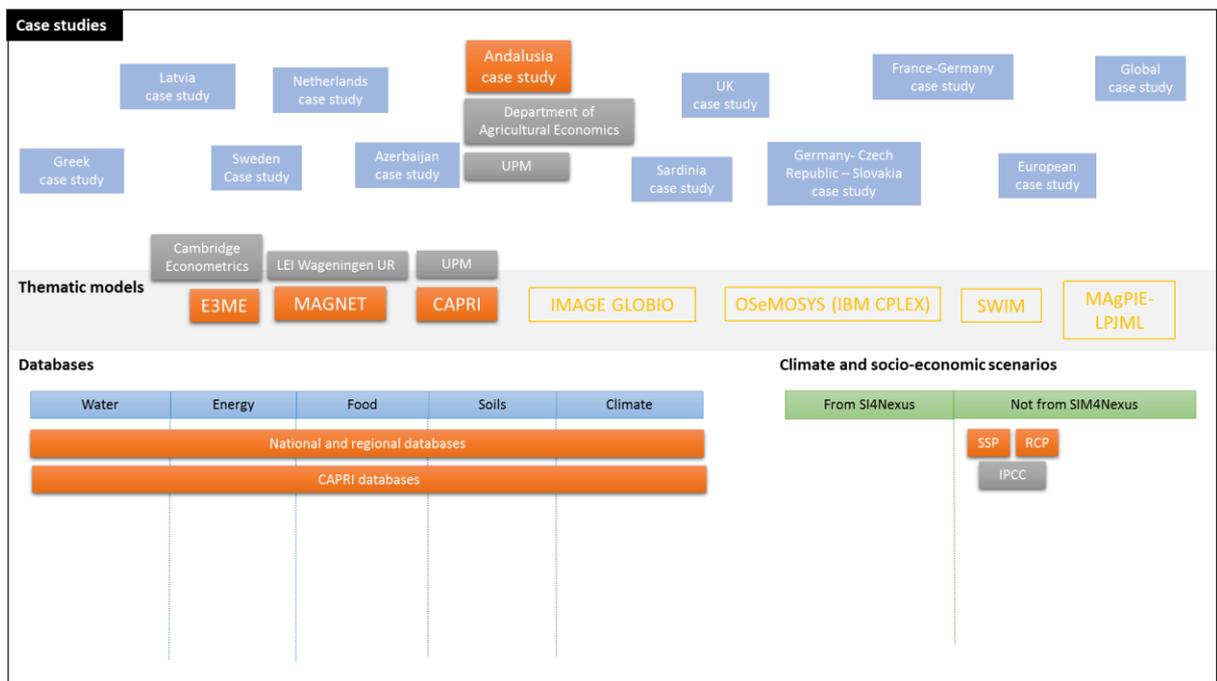


Figure 8: Map of the entities involved in the Andalusian case study

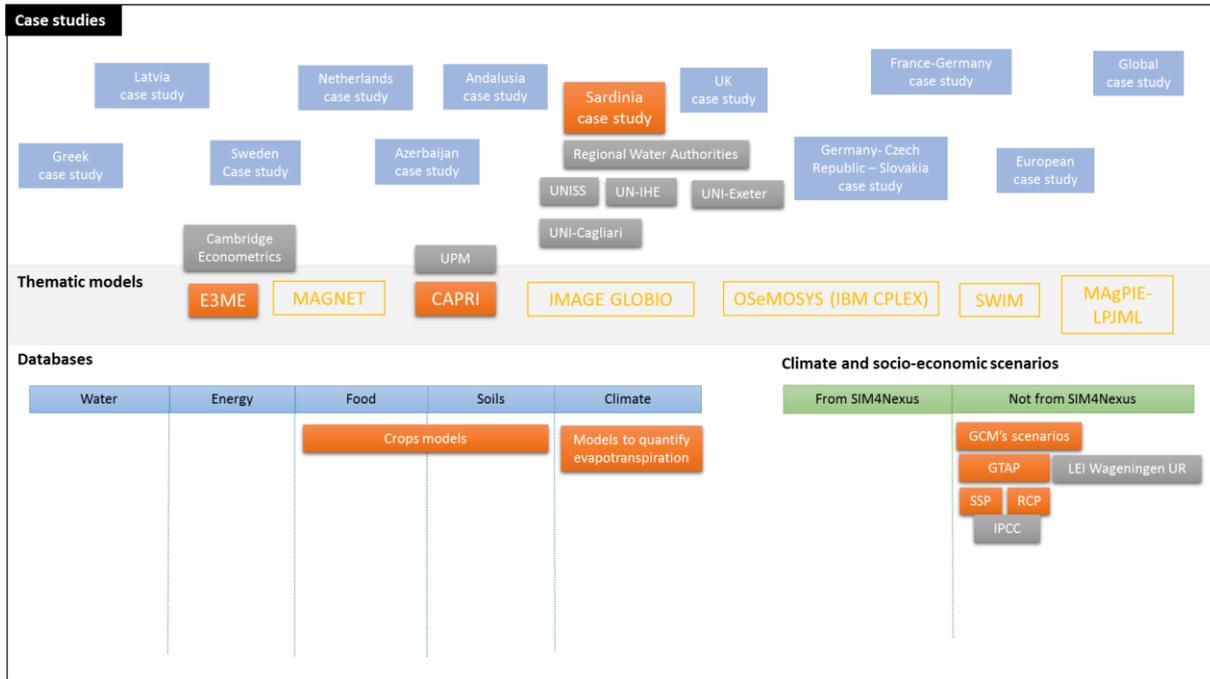


Figure 9: Map of the entities involved in the Sardinian case study

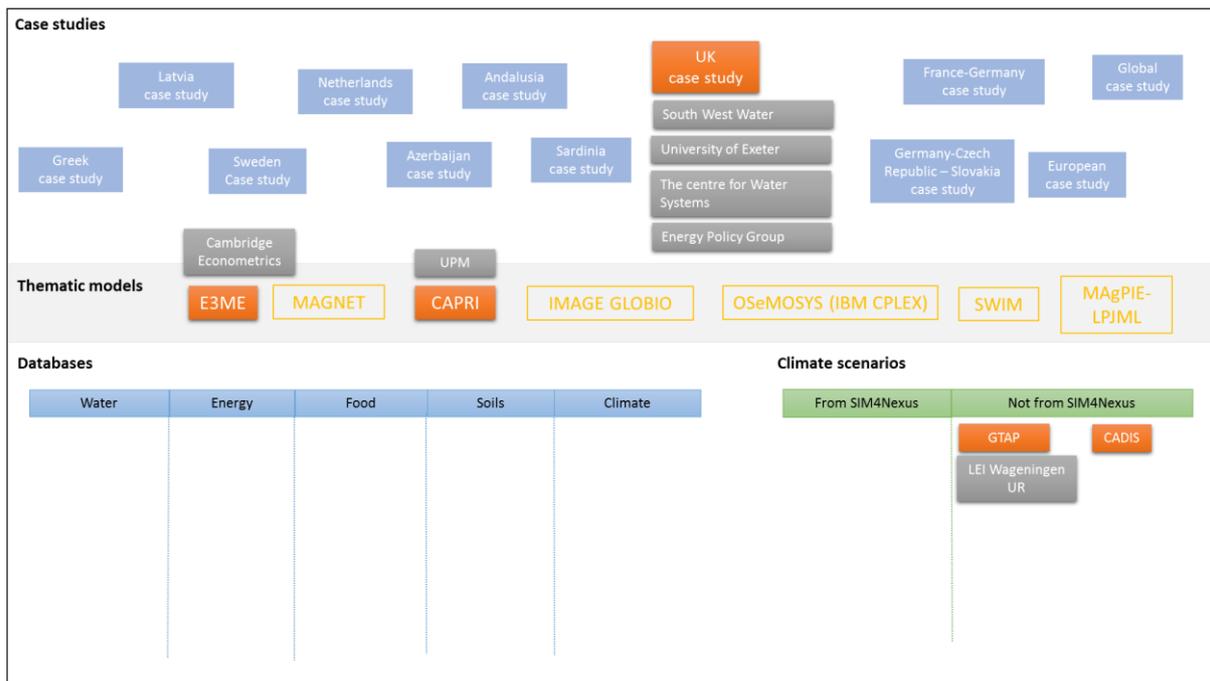


Figure 10: Map of the entities involved in the UK case study

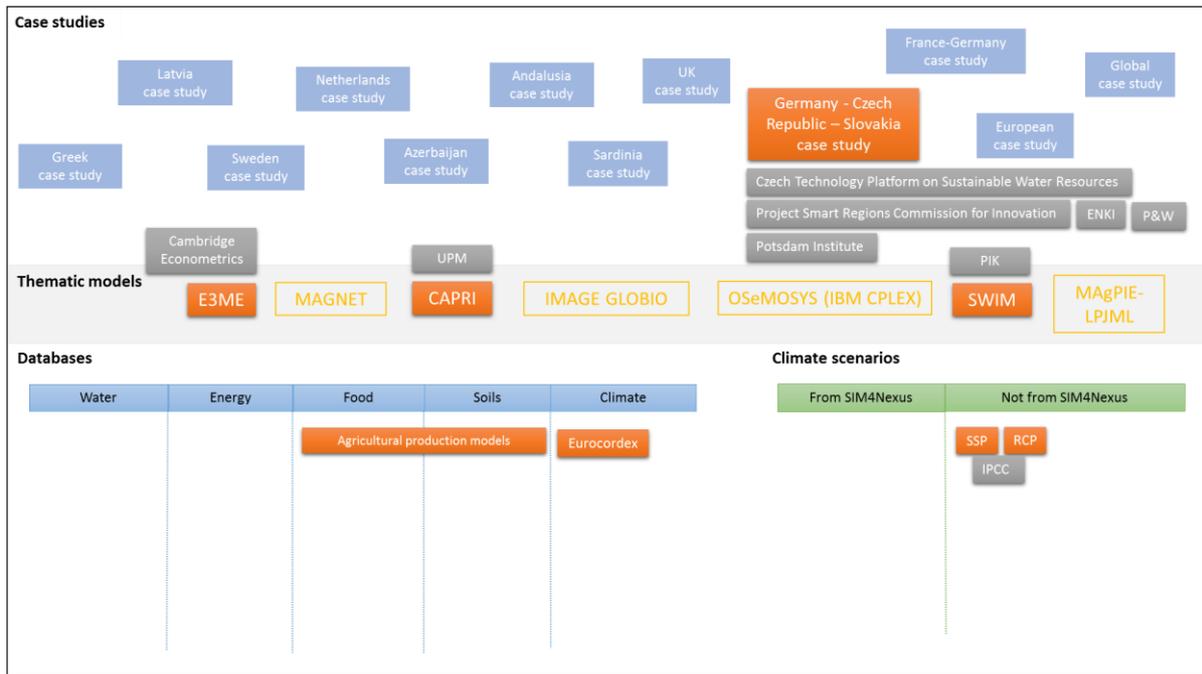


Figure 11: Map of the entities involved in the German - Czech - Slovakian case study

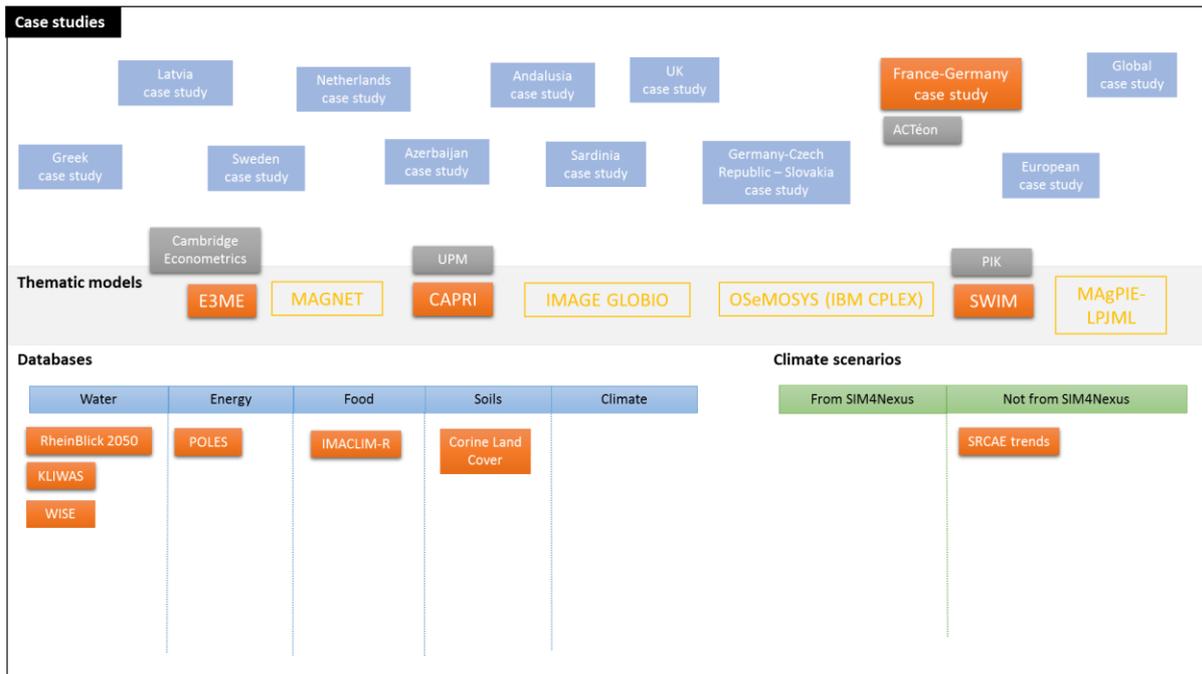


Figure 12: Map of the entities involved in the French - German case study

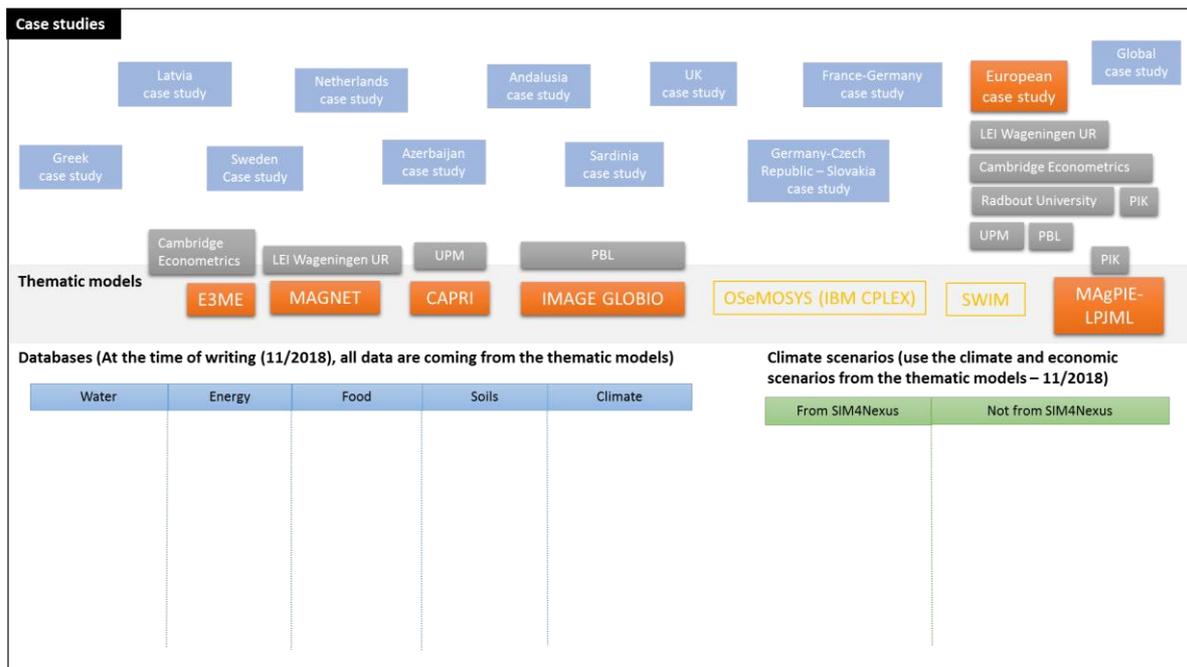


Figure 13: Map of the entities involved in the European case study

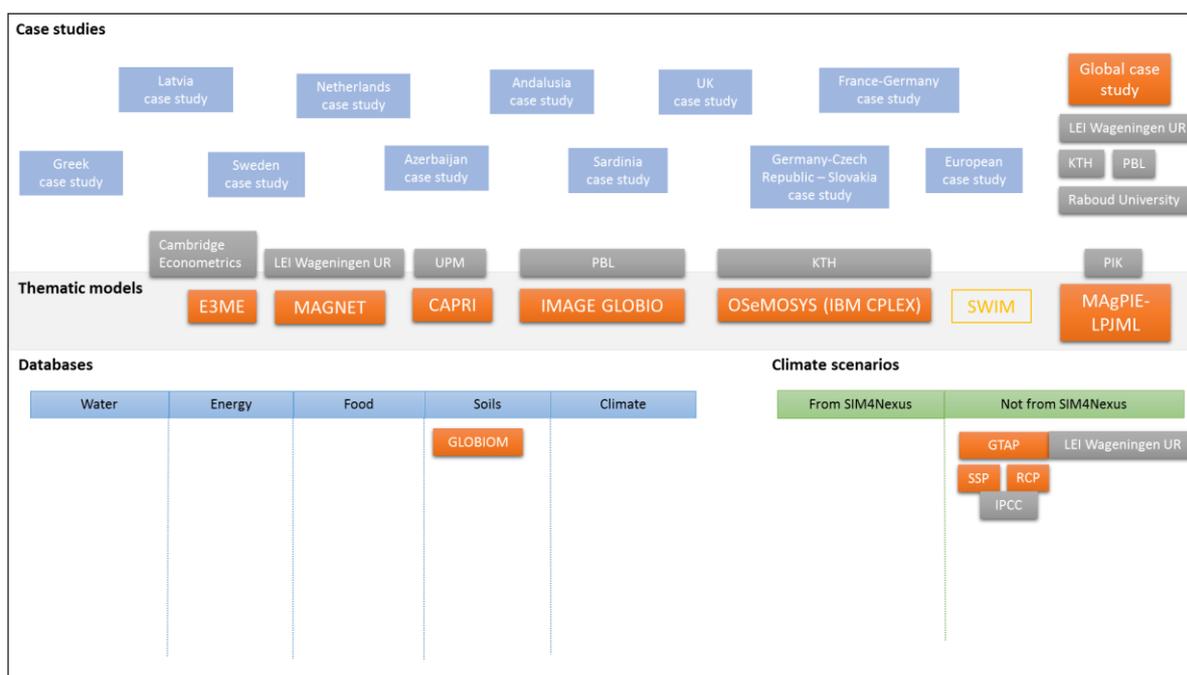


Figure 14: Map of the entities involved in the Global case study

These figures help grasp the complexity of interactions in the SIM4NEXUS project and to set it as the basis of all the discussions for the ownership of data produced in the project. This is an important element to set up the exploitation rights and strategies for the use of the different data included in each CS and also in the SG (including the KEE and the data repository).

For instance, the **Greek case study** has developed its SDM based on:

- ❖ **Thematic models** : E3ME (Cambridge Econometrics), CAPRI (UPM), OseMOSYS (KTH)

- ❖ **Data sources** : Water data and waste water data (from EUROSTAT) as data sources; Energy data by municipality (Public Power corporation), Crop data & Livestock (ELSTAT), Crop water requirements (University of Cyprus), Land uses (disaggregation of national EUROSTAT value to regional data) (CORINE), climatic data (PIK) and Touristic data (Association of Greek tourism enterprises)
- ❖ **Climate scenario**: LIFE Project scenario (EU)

The Greek Study has used some specific databases related to their own situations to set up their models. It is the same methodology for all the different Case studies giving a very complex network of data and owners associated for the whole project.

The wide heterogeneity among the case studies and their related SDM is a key challenge for the exploitation:

1. The lack of comparability among case studies makes it difficult to assess the precision and the reliability of the SDM, which is very important to potential clients
2. The variable use of thematic models and databases implies to involve a very large number of model and data owners, with complex consideration as regards the ownership data inputs, intermediates and outputs, and therefore complex agreements to set up.
3. The number of stakeholders impacts also the transferability of the SDM and SG since the data and models may be available or relevant only on specific geographic and information scopes. transfer would be limited by the availability of similar models and data at the similar level of details with similar architectures.

For exploitation and commercial purposes, it would have been preferable if the project would have developed a common SDM with a standard architecture. However, this recommendation is not part of the initial plan of development of the SIM4NEXUS project. For this reason, it is recommended to consider using each different SDM separately for the exploitation purpose especially for consulting purpose where each specific SDM could answered the specific questions raised by the local clients.

3.2.4 Steps to implement a new case study

This chapter summarises the latest status regarding the development of a new case study / SDM and the related resources required.

5 phases were identified to develop a case study from scratch and are detailed in the table 3:

- 1) Project preparation
- 2) Policy coherence analysis
- 3) Conceptual model designing
- 4) Thematic model data extraction
- 5) System Dynamic Model development

The table 3 reads as follows:

- The left column lists the actions identified for generating a new case study at each phase, based on information provided by the partners
- The middle column lists the reusable materials for a new case study, such as databases, climate scenarios, expertise or methodologies developed during SIM4NEXUS. This column only refers to the results generated by SIM4NEXUS (excluding therefore the thematic models).
- The right column estimates the resources required to accomplish the different tasks.

	Actions	Reusable material from SIM4NEXUS	Resources
Project preparation	<p>Scope and requirements definition of the new case study (depending on the study area)</p> <p>Gather or contact stakeholders around the case study (local stakeholders, technical / university partners, ...) and creation of “partnership agreement”.</p> <p>State of the Art of the Nexus and the potential interlinkages between the components of the Nexus on specified areas.</p> <p>Identification of existing data-sources (Eurostat, GEOSS, national, regional, local) and their data access protocol</p> <p>Identify the focus issues and relevant policy sectors for the case study</p> <p>Map out the socio-economic context relevant for the case study issues</p> <p>Map out the stakeholders and their power and interest structure for the relevant policy sectors</p>	<p>Nexus Knowledge (Components behaviour, interlinkages, ...) and scientific inventory</p> <p>Data and databases (inputs and outputs from previous case studies)</p> <p>Expertise in data analysis</p> <p>Expertise in stakeholder’s consultancy</p> <p>Policy analysis and policy classification methodology</p>	<p>2 months with a team of 2 persons</p> <p>Purchase data access</p>

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Policy coherence analysis</p>	<p>Mapping out the policy space Analysis of the available and required data regarding the scope of the study Identification and classification the relevant policies for the new area Discussion with the stakeholders about policies Map out the goals and means for each of the relevant policy sectors. Assessing policy coherence In-depth interviews with stakeholders Assess interactions between Nexus critical objectives Assess interactions between Nexus critical instruments and Nexus critical objectives Assess vertical interactions between policies Identify formal and informal rules and practices to handle conflicts, negotiate trade-offs and exploit synergies Identify success stories and failures Validation of the assessment of policy interactions Improving policy coherence (to come)</p>	<p>The methodology of mapping out the policy space, of assessing policy coherence and of improving policy coherence.</p>	<p>4 months with 2 persons.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Conceptual model designing</p>	<p>Study interlinkages between the Nexus components on a scope. Define the major Nexus components that will be explored Define numerical data needed from the thematic model to populate the conceptual model Data collect through stakeholders (food production, level of water, GDP, cereals production, ...) Choose the thematic model regarding time scale, spatial scale, Nexus components, costs, etc. Select a baseline for the scenarios regarding the previous considerations. Transcription of the policies into numerical data. Integration of the “numerical policies” in the conceptual model</p>	<p>Expertise on the Nexus components interlinkages Baseline scenarios and expertise. Policies analysis and translation in numerical data Contract with thematic model company Methodology and knowledge of combination of data with other model (verify the compatibility of data) (trends instead of average value)</p>	<p>3 months with a team of 2 persons Expertise in model translation in mathematical/numerical form.</p>

Thematic model data extraction	<p>Run the thematic model by the thematic model developers to get data and populate the SDM</p> <p>Analysis of outputs data from thematic models</p>	<p>Thematic model data extraction expertise</p> <p>Contract with thematic model developers.</p>	<p>3 months with a team of 2 persons</p> <p>Direct contact with thematic model's developers</p>
System Dynamic Models development	<p>Feed the SDM with data (thematic and model data, etc.)</p> <p>Test of the SDM</p> <p>Analysis of SDM results</p> <p>SDM modification and adjustment (soft calibration)</p> <p>Results from SDM in Stella format</p> <p>Translation of the Stella code in Python script</p>	<p>SDM set-up expertise</p> <p>Data/baseline for update</p>	<p>2 months with a team of 2 persons</p>
TOTAL	<p>Total resources estimated for implementing one case study: 14 months and 2 persons.</p> <p>The cost of one case study is then estimated to around 150 000 €</p>		

Table 3: Steps for implementing a new case study

3.2.5 Analysis and conclusions

Transferability is a key aspect of exploitation. A new case study will cost an estimative **150 000 €, 14 months and 2 persons**. This cost and timeframe might be too high for a single client. Amortising the SDMs on as many similar cases as possible would considerably improve the economics of the exploitation of SIM4NEXUS. This is an average estimation for a new case study. Of course, the time and price would be highly dependent of the size of the case study. For example, an island like Malta would require less resources than a study at the continental scale. Also, the analysis level of details should have implications as well.

Case study leaders are also capable, on a case-by-case basis, to develop new case studies, based on the expertise, experience and knowledge acquire during the project. The duration and cost presented above would then be highly shorten. The experience of SIM4NEXUS also shows that the most difficult, time consuming and expensive part in the process of developing new case studies are to collect field data and subsequently develop the modelling.

Another way to reduce this extra effort would be to adapt the already detailed case study for other regions/countries. For instance, should the Sardinia SDM be reused for other large Mediterranean islands with similar environmental and economic conditions like Corsica, Corfu, Sicilia, Crete, Cyprus, Malta, Mallorca? It could be amortised on many more cases without requiring to fully re-develop an SDM from scratch. Similar questions could be raised for the Swedish case to other Scandinavian

countries, the Netherlands for Benelux region, Latvia for all Baltic States and other Eastern European countries.

It is highly recommended for the Go / No Go decision on Month 36 to:

- Focus on the use and reuse of SIM4NEXUS data for consulting and training purpose. It is important now to define what type of data can be produced out of the project to be able to propose specific consulting and training sessions.
- In order to enlarge the parameter of the data use, it would be important to study the transferability of each case study individually and define other geographic areas where they could be used and the modalities for transfer
- In order to target the maximum of end-users, it would be necessary to study how to optimise the time, and therefore the price, to implement a fully new case study from scratch and define a detailed procedure. Some task could be parrallelised to gain some time.

3.3 Nexus Business Group (NBG)

The Nexus Business Group is related to the task T6.2. At first (and in the proposal in the Grant Agreement), this task was named “SIM4NEXUS Ecosystem Group” (SEG). However, during the Athens’ project meeting (May 2018), several partners have raised the issue that “Ecosystem Group” might be misinterpreted as Ecosystem as another meaning in the general public. It has been then decided to name the T6.2 to “Nexus Business Group (NBG)”.

The initial purpose was to group prospects and potential early adopter that would be interested in following up the technical developments of the project and giving input and advices. The idea was to gather some potential end-users to pre-sell the outputs of the project and get eventually feedback from their needs. They would test and review the final product and services.

Up to now, the development of the project was not enough advanced to gather the interested stakeholders and potential clients. The Nexus Business Group (NBG) must be set up by the end of the project. The workshops which may be open externally (e.g. to clients, partners, local authorities, sister projects...) may prototype the NBG, which in turn may prototype the NPO recommended in this report for project outputs of general interest. A deliverable (D6.5 due for M48) will summarize the NBG activities and recommend actions on its future development.

During the last project meeting, a specific workshop on exploitation of the Serious Game has been organised including several UK stakeholders that have attended the meeting:

Eden Project
REGEN
CCRI, Uni of Gloucester
South West Water
Devon County Council
Cornwall Council
Anglian Water
Exeter University

Environment Agency
Torbay Council
Westcountry Rivers Trust
Energy Policy Group, Exeter University
NFU
Clinton Devon Estates
Natural Environment Research Council
UKWIR
Natural England / DEFRA

Table 4: List of external stakeholders that have attend the workshop on exploitation in Exeter, meeting (16 November, 2018)

This workshop could be considered as the first Workshop of the NBG. WP6 will organized at least 2 other workshops in 2019 to build network of potential network. The communication associated in collaboration with WP7 will also be important to outreach to potential users. The communication will focus on how much can be learned from the Serious Game. The NBG need to create an event with not only potential end-users but also EU member states and journalists specialized in environment and gaming. That would make a lot of publicity for SIM4NEXUS and bring more adhesion to the project from external persons.

The Nexus Business Group could be the prototype organisation for the Foundation as all the person invited in the different workshops could be the first members of the foundation.

The next workshop should be organised in spring 2019 in Brussels as it is a central place for the invited persons. The best would be to organise a side event of a big event.

The first clients could be the persons already contacted during the market study and that have shown a strong interest in the project and/or the Serious Game. The listing of the attendants of the first Nexus Project Cluster conference could also be used to invite people.

All these actions will boost the interest in SIM4NEXUX project, product and services during the last year of the project. The action plan for the NBG is detailed in the next chapter: action plan from M30.

4 Innovation management

4.1 Scope of the exploitation strategy

The scope of the exploitation strategy is related to the Go/NoGo milestone of the project for the exploitation of the results and includes the exploitation of joint results generating impact as:

- the creation of new startup or spinoffs (for-profit or not-for-profit),
- the development of new societal activity
- the development of new products / services.

This exploitation strategy will be supported by Strane Innovation in close collaboration with the interested partners.

The scope of the Go/NoGo Milestone does not include:

- the individual exploitation of results owned by one single partner. For all results generated during the project, participant shall make best efforts to exploit the results on their own or to have them exploited by another legal entity.
- Future research
- Standards

Strane Innovation will support the self-exploitation of the case studies who want to do so by organising skype events and workshops and help them in building their business plans.

The overall exploitation strategy described here in the D6.1 will look at all the potential exploitation (joint or individual) that could be set up from the project results.

4.2 General Intellectual Property Right Management

Although none of the tasks described in the work plan of the SIM4NEXUS project are specifically dedicated to the management of the Intellectual Property Rights and no partner has been designated as IPR manager, the Grant Agreement stipulates in different paragraphs (see §1.3.4 overall approach and methodology; §3.3 Consortium as a whole – Objective 4) IPR-related issues with regard to Strane Innovation's exploitation strategy. In consequence Strane innovation will manage the IPR in collaboration with the project management (WUR-LEI).

The Grant and Consortium agreements (involving each partner in the project and one with each other) are summarized in the following chart showing in figure 16 the IPR and obligations of the partners concerning the exploitation, dissemination, protection and access of the results.

Different choices are possible concerning the results:

- Transfer of license
- Dissemination
- Protection
- Access to the results

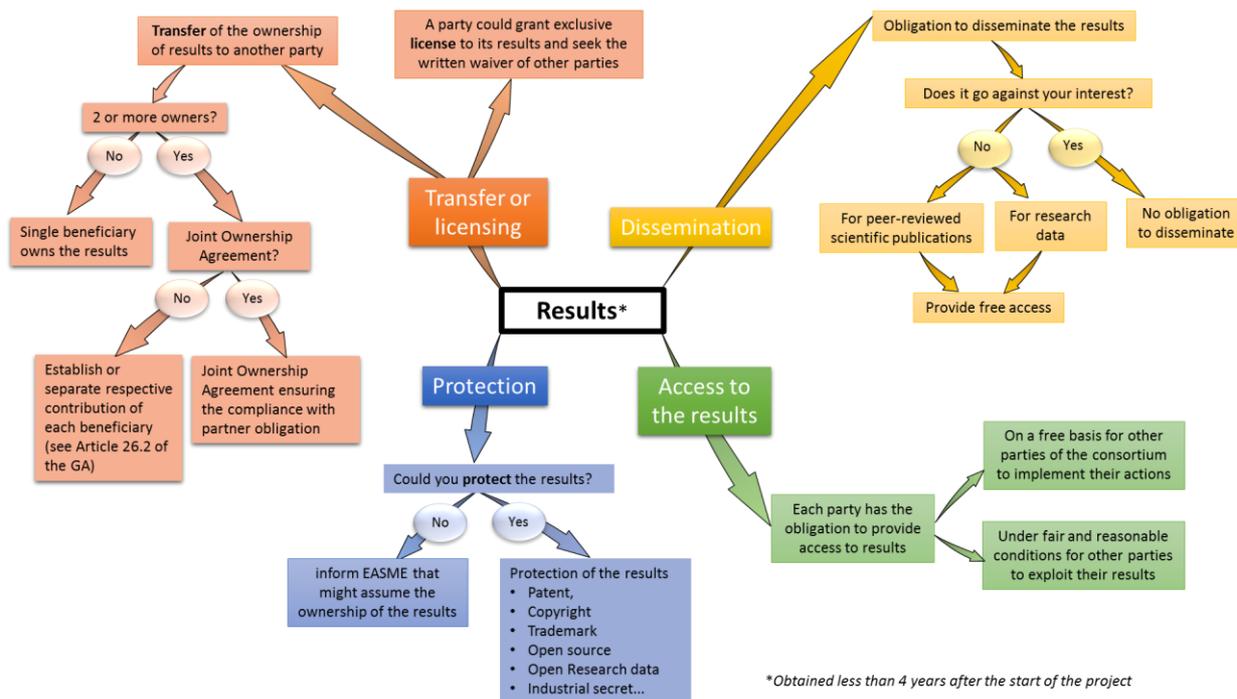


Figure 15: Graph summarizing the Intellectual Property rights and obligations of SIM4NEXUS partners concerning the exploitation, dissemination, protection and access of the results from the analysis from the SIM4NEXUS Grant and Consortium agreements.

4.3 SIM4NEXUS Intellectual Property Right Management

The following table 4 lists the SIM4NEXUS partners involved for the main project outputs²:

SIM4NEXUS outputs		SIM4NEXUS Partners involved	
Serious Game	KEE	EURECAT, University of Exeter	
	SDM	Greece	University of Thessaly, Cambridge Econometrics, LEI Wageningen, UPM, PBL, KTH, National Observatory of Athens
		Latvia	Baltic Environmental Forum Cambridge Econometrics, UPM Ministry of Environment of Latvia
		Sweden	Uppsala University, Swedish University of Agricultural Sciences, Cambridge Econometrics, LEI Wageningen, UPM, PBL, PIK,
		Netherlands	LEI Wageningen, Netherlands Environmental Assessment Agency, Cambridge Econometrics, UPM, PBL, PIK
		Azerbaijan	KTH, UPM, Cambridge Econometrics, LEI Wageningen,
		Andalusia	Department of Agricultural Econometrics, UPM
		Sardinia	Regional Water Authorities, Regional Ministry of the Environment, Cambridge Econometrics, UPM, PBL
		UK	SWW, U of Exeter, Centre for Water System, Energy Policy Group, Cambridge econometrics, UPM

² TO ALL PARTNERS: Please review and check, please do not hesitate to correct any mistake.

	Germany – Czech Republic – Slovakia	Czech platform on sustainable Water resources Project Smart regions Commission for Innovation, PIK
	France Germany	ACTéon, PIK, Cambridge Econometrics, UPM
	European	Cambridge Econometrics, LEI Wageningen, UPM, PBL, KTH
	Global	Cambridge Econometrics, LEI Wageningen, UPM, KTH, PBL, PIK
	GUI	DHI, EURECAT, EPSILON, University of Exeter
Policy Analysis		WUR LEI, PBL, UNESCO-IHE, UNU, PIK, UPM, RU, KTH, UU, UNISS, ENKI, PBL, SWW, ACTéon, FT, BEF, ACSDA, P&W

Table 5: Description of the partners involved in the outputs that are required for the development of the Serious Game

The table 5 below summarizes for the main project outputs, the area of application (i.e. serious game and/or consulting services, applicability area...), the IP holder(s) and potential IP management options.

Project output	Application	IP holders		IP management options
		Partner SIM4NEXUS	Outside SIM4NEXUS	
SDM Andalusia	Serious Game Consulting in Andalusia Consulting Spain?	UPM, Department of Agricultural Economics		Open Access Scientific publication, policy briefs
SDM Island of Sardinia	Serious Game Consulting in Sardinia Consulting in other Mediterranean islands?	UNISS, CE, UPM, PBL	Regional Water Authorities, Regional Ministry of the Environment	Open Access Scientific publication, policy briefs
SDM Southwest UK	Serious Game Consulting in UK Consulting in other utilities in UK? Consulting in other utilities in other countries?	SWW, UNEXE, CE, UPM	Energy Policy Group	Open Access Scientific publication, policy briefs
SDM Netherlands	Serious Game Consulting in Netherlands Consulting in Rhur Region? In Belgium? In Denmark?	WUR-LEI, PBL, CE, UPM, PBL, PIK,		Open Access Scientific publication, policy briefs
SDM Sweden	Serious Game Consulting in Netherlands Consulting in Norway? In Finland?	Uppsala University, Swedish University of Agricultural Sciences, CE, WUR-LEI, UPM, PBL, PIK,		Open Access Scientific publication, policy briefs
SDM Greece	Serious Game Consulting in Greece (bank?)? Consulting in other country?	UTH, CE, WUR-LEI, UPM, PBL, KTH,	National Observatory of Athens	Open Access Scientific publication, policy briefs
SDM Latvia	Serious Game Consulting in Latvia Consulting in other country (Estonia? Lithuania?)	BEF, CE, UPM		Open Access Scientific publication, policy briefs
SDM Azerbaijan	Serious Game Consulting in Azerbaijan? Consulting in other country?	ACSDA KTH, UPM, CE, WUR-LEI		Open Access Scientific publication, policy briefs

SDM Transboundary France - Germany	Serious Game Consulting in other part of France? Consulting in other part of Germany? Consulting in other country?	ACTéon, PIK, CE, UPM		Open Access Scientific publication, policy briefs
SDM Transboundary Germany – Czech Republic - Slovakia	Serious Game Consulting in other part of Germany? Consulting in other part of Czech Rep? Consulting in other part of Slovakia? Consulting in other country?	PIK, ENKI, P&W	Czech platform on sustainable Water resources Project Smart regions Commission for Innovation,	Open Access Scientific publication, policy briefs
SDM Europe	Serious Game Consulting for European agencies Knowledge awareness - training	CE, WUR-LEI, UPM, PBL, KTH		Open Access Scientific publication, policy briefs
SDM Global	Serious Game Consulting for UN Conventions and other international organisations Knowledge awareness - training	PBL, KTH, CE, WUR-LEI, UPM		Open Access Scientific publication, policy briefs
Expertise: SIM4NEXUS Framework for Assessment of Nexus; Science and data/ information	General knowledge for NPO	UNESCO-IHE, PIK, UPM, UB, RU, KTH, WUR-LEI, UTH, UNEXE		Scientific publication Open access
Thematic models	Part of SDM → Serious Game and consulting	PIK, UPM, PBL, RU, KTH, WUR-LEI, CE		Except CE: free, but not open source CE: proprietary
Complexity of science modelling	Part of SDM → Serious Game and consulting	WUR-LEI, UNEXE, UTH, UNESCO-IHE, UNISS		Open source, free
GeoPlatform and KEE incl. Nexus data and metadata	Commercial exploitation: Serious Game Consulting company Training	EURECAT, EPSILON		Proprietary Free for joint exploitation Non-exclusive
Serious Game: Database with Nexus data	Commercial exploitation: Serious Game Consulting company Training	EPSILON		Open source Free maintenance
Serious Game: Semantic repository	Commercial exploitation: Serious Game Consulting company Training	EPSILON		To be determined
Serious Game: Graphical User Interface	Commercial exploitation: Serious Game Consulting company Training	DHI, UNEXE		Proprietary Free for joint exploitation,

				Free and/or payable
Serious Game: Finished product	Commercial exploitation: Serious Game Consulting company Training	All partners		Proprietary Free for joint exploitation, Free and/or payable
Nexus compliant practices: Case Study Descriptions, quantified improvement via NPIs	General knowledge for NPO Commercial exploitation: Serious Game Consulting company Training	All partners involved in WP5		Workshops with Stakeholders; Open Access Scientific publications; Policy briefs
Final delivery with all individual modules integrated	Commercial exploitation: Serious Game Consulting company Training NPO	SI, FT, WUR-LEI, DHI, EPSILON, UTH, UNEXE, PBL, KTH		Spinoff ventures

Table 6: Expected IPR strategy for all the results of SIM4NEXUS

Part of the information displays in the table 5 has been gathered from the table put in the SIM4NEXUS Grant Agreement. It shows the different outputs expected at the beginning of the project and expected protection that partners have expressed at that time for their results. After 30 months of development, this information needs to be updated by all the partners producing any outputs.

5 Detailed exploitation strategy

5.1 Exploitation strategy options

All SIM4NEXUS partners are encouraged to declare their exploitation strategy for their results:

- **New spinoff on their own:** The partner would like to exploit their own results by themselves in a new structure or inside their own organisation
- **New spinoff in partnership:** partners would like to exploit their result jointly with other partners (creation of a new structure with a joint agreement contract).
- New service
- Licensing
- Patent sale

In the following table (table 6), the latest expressions of individual communication / dissemination / Exploitation plan for SIM4NEXUS partners are presented (*source: Grant Agreement, November 2018*).

Participant name	Type	Individual Communication/Dissemination/Exploitation Plan
WUR-LEI	R&D	<ul style="list-style-type: none"> Support international organisations, enhancing Nexus-compliant practices Strengthen the modelling capacity in the Nexus-domain
UTH	University	<ul style="list-style-type: none"> Graduate students will gain knowledge and experience from the Nexus science, as well as multi-disciplinary modelling frameworks, providing them with better job opportunities and creating a driving force for distilling know-how to industry. The cooperation with major networks (e.g. EIP-Water Action Groups, WssTP Working Groups), industrial partners and SMEs will give more concreteness to academic research and to acquire practical experience on seeing how to apply theoretical knowledge in practice.
UNEXE	University	<ul style="list-style-type: none"> Exploitation of the complexity science products with a consultancy startup Organising workshops with students for training/using the serious game Organising special sessions alongside international Conferences Organising special issues for journal papers Linking with IPCC people/activities (Catherine Mitchell)-communicating back and disseminating results in IPCC events
UNESCO-IHE	R&D	<ul style="list-style-type: none"> Masters students will gain knowledge and experience deriving from SIM4NEXUS. New science will be directly incorporated into numerous teaching activities. Publishing widely in leading international journals and in special issues Participating at major international conferences and in specially organised sessions.
PIK	R&D	<ul style="list-style-type: none"> Workshops with stakeholders and students to get feedback on the serious game Special sessions alongside international Conferences of EGU (European Geosciences Union) and AGU (American Geophysical Union) and a special issue in a journal as Reg. Env. Change Stimulating the AR6 process of the IPCC, collecting feedbacks <p>Introducing SIM4NEXUS to the ISI-MIP (Inter-Sectoral Impact Model Intercomparison) Project) community</p>
UPM	University	<ul style="list-style-type: none"> Integrate nexus science and tools in post-graduate training activities. Enhance nexus decision-making in European modelling networks. <p>Contribute to policy workshops, international conferences and high-level academic publications.</p>
UB	University	<ul style="list-style-type: none"> Collaboration with the Barilla Centre for Food and Nutrition, for the organization of public dissemination events. Summer School for graduate students on Complexity Science modelling and Serious Gaming
UNU	University	<ul style="list-style-type: none"> The global Nexus science will be included in courses at MSc level and PhD students will follow-up, using the Serious Game. Link with IPCC activities (Koko Warner) – communicating back and disseminating results in IPCC events.
RU	University	<ul style="list-style-type: none"> Contribute to relevant scientific conferences and workshops; publish in international journals. Use the Nexus science in courses with PhD students.
KTH	University	<ul style="list-style-type: none"> The Nexus science will be included in courses at MSc level, and potentially in thesis projects; dissemination through different mailing lists. Create links with the energy modelling community via the OSeMOSYS community forum Collaboration in UNDESA, UNECE and WB sustainable development processes

UU	University	<ul style="list-style-type: none"> Organize workshops to present and discuss project output and results with the stakeholder community. These workshops provide a venue presenting the SIM4NEXUS game and will also provide an opportunity to learn more about the value of the project results for stakeholders
Eurecat	R&D	<ul style="list-style-type: none"> Participate in relevant related conferences and workshops; publish in international journals. Collaboration with OGC® Hydrology Working Group to disseminate SIM4NEXUS advances. Make use of H2020 WIDEST project network and ICT4Water cluster to disseminate SIM4NEXUS results and outcomes. Exploitation of the KEE with a technology startup. Increase technology transfer thanks to experience obtained from collaboration with EIP-Water Action Groups, WssTP, industrial partners and SMEs.
UNISS	University	<ul style="list-style-type: none"> Consolidate the connection with the Regional Ministry of the Environment to develop sustainable development plans for Sardinia. The SIM4NEXUS experience will be used as example of integrated assessment methodologies for the Nexus, to support climate adaptation policies in Italy. MSc and PhD students will be introduced and possibly involved in the Nexus science
ENKI	R&D	<ul style="list-style-type: none"> Support the Ministry of Environment on certified methods for sustainable water management, as well as the Governmental Commission for “Drought and flood prevention” on Nexus-compliance practices in the Czech Republic. Regional authorities will also be informed about the outcomes of SIM4NEXUS. Involve MSc students on integrated assessment methodologies for the Nexus.
PBL	Public Body	<ul style="list-style-type: none"> Share results with governmental bodies and research organisations in the network at global (e.g. UNEP, IPCC), European (e.g. EU, European network of Environmental Protection Agencies), national and regional scales. Contribute to debates and disseminate through social media.
DHI	Industrial	<ul style="list-style-type: none"> Apply the serious game in related training courses conducted by DHI, as well as in related educational activities for secondary and tertiary education Contribute to international conferences and journal articles Exploitation of spinoffs opportunities
SWW	Industrial	<ul style="list-style-type: none"> Apply the serious game for secondary education at a new University College for future water industry employees. Share results with the UK Water Industry Trade Association, Water UK. Share results with the ‘Catchment Partnerships’ established in the South West of the UK – multi partner groups seeking to balance WFD compliance with land use, employment and climate change.
ACT	SME	<ul style="list-style-type: none"> Organise policy workshops; contribute to policy workshops and policy papers Apply the serious game for primary/secondary education and civil society Contribute to international conferences and journal articles
EPSILON	SME	<ul style="list-style-type: none"> Introduce SIM4NEXUS to the Malta Environment Agency and the University of Malta, Department of Geology & Environment. Organization of training sessions in Malta. Cooperation with the Water Authority, Ministry of Agriculture. Exploitation with local engineering and consulting groups and establish a network. Publish 10 newspaper articles on SIM4NEXUS.
SI	SME	<ul style="list-style-type: none"> Investment in the project spinoffs Extend the European network of the company Research on the convergence of its sectors of expertise (Energy, water, transport, environment) through natural nexuses and transverse innovations

FT	SME	<ul style="list-style-type: none"> Inclusion of knowledge and eventually tools in future (policy, planning and implementation) projects, other consultancy work and training/dissemination activities
BEF	NGO	<ul style="list-style-type: none"> Extend the cooperation network of environmental NGOs, professional associations, municipalities
P&W	NGO	<ul style="list-style-type: none"> Multisectoral interaction workshops and training for stakeholders (including regional governments) to cope with climate change A training program “hydroclimate summer schools” for students and members of partners university, research institutions, NGO and SMEs Lectures for high schools ‘restoring natural water cycles and climate’
WssTP	Tech Platform	<ul style="list-style-type: none"> Incorporate the knowledge in sector-wide activities, such as training or drafting of (policy) documents Usage of knowledge within the WssTP Working Groups (e.g. Water-Energy-Food Biodiversity Nexus, and also Agriculture, Membrane Innovation, Shale Gas). Foster the uptake of knowledge and tools by WssTP members and other water institutions, and share results with public authorities, SMEs, water industry and European institutions through dissemination activities.

Table 7: Individual communication / Dissemination and exploitation plan for SIM4NEXUS partners

This table lists the intend of some partners to be part of the of the next step. Most part of this intention of communication/dissemination and exploitation route expressed by the partners can be included as individual or joint exploitation in the strategy of a Non-Profit Organisation (NPO) which is presented in the next section.

5.2 Non-profit Organisation (NPO)

5.2.1 Overview

The NPO purpose would be to promote the sustainable resource management through a Nexus approach. The specific objectives would be to:

1. Be a central point of the world’s research on nexus by synthesising and networking research team worldwide
2. Deploy the scientific knowledge to companies (through consulting services) and to the general public (through awareness-raising tools like the Serious Game and communication & dissemination activities)

The NPO would be composed of 3 major bodies:

- The **executive team**, composed of employees, would manage the daily work and the administrative aspects.
- The **scientific board**, composed of volunteering researchers (delegated from their laboratories), would supervise the NPO scientific activities. Working groups could be inspired from the WPs of SIM4NEXUS: a) the Science of the Nexus, b) Modelling the Nexus, c) Nexus policies, d) Nexus case studies. Researchers may be involved in consulting missions sold by the NPO and their employer or them directly would be remunerated for this work.
- The **Nexus Business Group**, composed of industrial partners and public authorities, would advise on the research activities and outputs of the NPO to ensure the link between research activities and industrial needs.

The Executive Team would support the activities of the Scientific Board and NBG, and their deployment to society and businesses. It would carry out several activities, especially:

- Organise an annual conference which should become a global reference
- Support the scientific activities administratively and acquire subsidies to carry out research activities
- Sell consulting projects to businesses and manage the project with the engaged researchers
- Maintain and advertise the Serious Game
- Communicate & disseminate knowledge

Figure 16 shows the functioning scheme of the NPO and the stakeholders engaged.

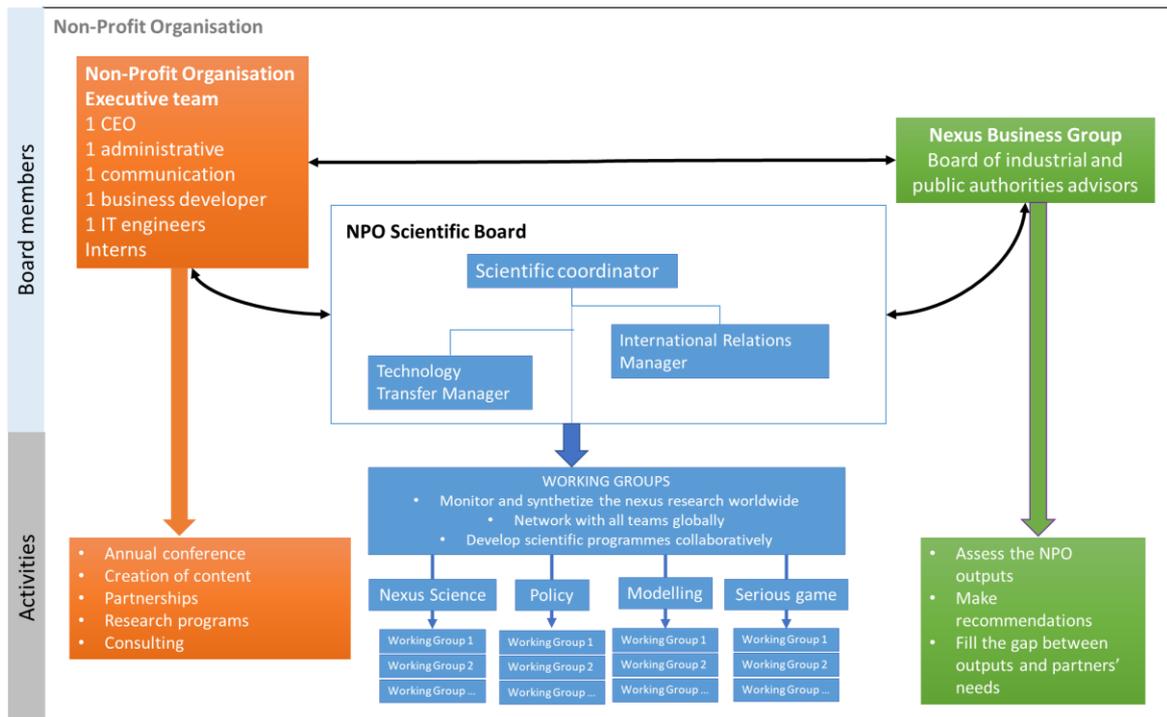


Figure 16: Overall schematic organisation of the Non-Profit Organisation of SIM4NEXUS

5.2.2 Team organisations and missions

5.2.2.1 Executive Team

The Executive Team would be composed of:

- One Chief Executive Officer
- One administrative staff
- One communication expert
- One business developer
- One IT engineer

Chief Executive Officer

The CEO of the Non-Profit Organisation would manage the operations on a day-to-day basis. He would be the legal signatory of the organization for the contracts and finance. He would liaise with the Scientific board and the Nexus Business Group.

Administrative person

The Administrative person would assist the CEO and all employees with administrative tasks: accounting and finance, legal aspects, office management, reporting and the follow-up of projects. It will follow up membership fees and invoices.

Communication person

The communication and dissemination of all activities of the non-profit organization is very important to have a very high impact on the scientific and civil society and be able to recruit new members and sponsors. The person in charge of the communication would act in close coordination with all the working groups of the scientific board and the Nexus Business Group to for a global communication towards donators, members, the scientific community, businesses and the general public. It would be also responsible for organizing the practical aspects on the Annual Conference.

Business developer

The Business developer would sell the consulting services to businesses and public authorities, and recruit new sponsors. It would also recruit new members.

IT Engineer

The IT engineer would manage the NPO's IT and maintain and update the Serious Game with the help of the working groups. He/she would implement new updates and SDMs to the Serious Game.

5.2.2.2 Scientific Board

The Scientific Board would lead the scientific activities of the NPO. It would be composed of a:

- Scientific Coordinator
- International relations manager
- Technology transfer manager
- Working Group Leaders

Scientific Coordinator

The Scientific Coordinator would coordinate the SB scientific activities and ensure they meet the highest standards of scientific quality and be the main contact point for the Executive Team. The Scientific Coordinator would report annually to the other members of the NPO actions undertaken during the year and the results and outputs produced.

International Relations Manager

The International Relations manager must recruit new research teams into the NPO WG and define collaborations and partnership agreements. He/she would also ensure the international outreach of the results and outputs of the NPO, especially by attending to conferences.

Technology Transfer Manager

The Technology Transfer Manager would supervise the innovation process of the NPO and source innovations that might be exploited commercially by the NPO or by new startups. It would support the IPR strategy.

Working Group Leaders

The WG Leaders would supervise the scientific activities of their working group. They would set the activity plan and objectives annually, engage with all WG members to make them contribute, and manage the activities. They may organize WG meetings or videoconferences. The activities could be to

- Monitor the latest advances in the scientific research in their domain
- Coordinate the activities of member researchers to support the research beyond state of the art

Working Group Members

Working Group Members would be mainly academics but also experts from businesses or public authorities. They would participate in their WG activities, monitoring the research on nexus, exchanging with other members. WG Members may also be involved in consulting projects sold by the NPO when their specific areas of competence are expected.

Working Group ideas

Working Groups would address specific topics. For instance:

- A Nexus science WG could monitor the state of the Art of the world's research on nexus science and foster exchanges between teams worldwide. It could organise international research collaborations.
- A Policy WG could assess nexus-related policies and update the database of policies developed in SIM4NEXUS and create or update SG policy cards. It could also formulate policy recommendations.
- A Modelling WG could network all research teams working on nexus models and advance the results from SIM4NEXUS related to the SDMs and possibly other modelling techniques.
- A Nexus Cases WG could manage the development of new case studies, expanding the findings from SIM4NEXUS case studies. It could liaise with local academic teams to engage stakeholders and apply SIM4NEXUS tools and methods
- A Serious Game WG could manage the development of the SG based on voluntary contributions to its code. It could maintain and update the game engine and graphical user interface, debugging issues and creating new features.

5.2.2.3 Nexus Business Group

The Nexus Business Group would be composed of industrial partners and public authorities interested in the sustainable management of resources. This board would assess the outputs of the NPO and its research activities, to ensure the link with real applications. The Nexus Business Group members would meet annually to report the main areas of interest of their sector in terms of sustainable resource management (e.g. impact of climate change on the value chain in the agro-industry food sector).

5.2.3 Commercial outputs of the NPO

Serious Game

FREE VERSION

The NPO would promote the online use of the SIM4NEXUS serious game. A free trial version would be accessible online. This version would propose some basic features, case studies and policy cards. This free version would tease the potential of the SG to stakeholders online.

FULL LICENSED VERSION

This full licensed version of the serious game would be accessible online with full options, case studies and policy cards of the serious game. The price remains to be defined depending on the costs to maintain and update this version. The price should not hinder people to play to the serious game but, on the opposite, the price should also cover the expenses linked to online hosting of the serious game on the NPO servers.

TRAINING SESSIONS

Training sessions will be offered to teach groups of people (in companies, universities, students, public bodies, etc.) how to use the full version of the serious game. An expert from the Serious Game WG could be engaged for training activities.

SERIOUS GAME HOSTING, MAINTENANCE AND UPDATE

The NPO would rent a server to host the serious game versions

The NPO would also maintain and update the serious game. The maintenance would focus on the sound functioning of the online version of the serious game and the integration of new tools or case studies implemented by the scientific board or the core team. The maintenance would be made by IT Engineer. Updates of the serious game would focus on the data and scenarios of the case studies already implemented under SIM4NEXUS. In the future, the updates will also include the new implemented case studies.

Scientific program

The NPO will apply to scientific programs related to the Nexus. These scientific programs will have to contribute to the sustainable resource management at large. These programmes would apply to subsidies worldwide.

Consulting

The NPO would lead activities of consulting for companies and public authorities. The consulting projects would be executed by the relevant scientific working groups. Consulting projects could include policy analyses, new model development, case study pre-feasibility study, impact assessment...

Communication & dissemination

The NPO will lead actions of communication and dissemination towards its members. The NPO will notably communicate and disseminate the outputs of the scientific board to its members. These actions of communication & dissemination will broadcast the results and outputs of SIM4NEXUS that are of general interest.

Annual conference

An annual conference could be organized to present the latest scientific advances related to the Nexus approach. This annual conference would showcase the forefront cutting-edge scientific outputs of the NPO and promote collaborative work and collaboration among the participants to this annual event. Then, annual conference will also serve to connect people and foster the international project creation.

5.2.4 Business model and Business plan of the NPO

As every organisation, the NPO must ensure that it generates benefits in order to be viable on the long-term. Benefits would be reinvested in the organisation to support its expansion. Table 8 lists the direct and indirect costs of the Non-profit organisation as well as potential revenue streams.

General costs	Specific costs	NPO activities	Specific revenues
<ul style="list-style-type: none"> - Travel expenses - Meeting/event organisation expenses - Specific equipment for webinar /workshop 	<ul style="list-style-type: none"> - Salaries - Overheads - Offices costs - Equipment - Taxes - Bank fees - Website, emails, phones - Global communication expenses - Dissemination tools and supports 	Executive team	<ul style="list-style-type: none"> - Access fees to the Serious Game - Training courses fees - Consulting project sales - Conference fees - Membership fees - Subsidies - Donation
	<ul style="list-style-type: none"> - IT infrastructure (Servers, software, databases, computer materials) - Maintenance of IT infrastructure - Updates of SDMs, use cases and Serious Game 	Scientific board	<ul style="list-style-type: none"> - Grants for research activities - Consulting services sales
	<ul style="list-style-type: none"> - Travel reimbursement expenses 	Nexus Business Group	<ul style="list-style-type: none"> - Membership fees

Table 8: Business model for the Non-Profit Organisation detailing costs and revenues of the organisation according to the different activities of the organisation

The business plan of the NPO relies on the sound execution of operations from the Executive Team and on the volunteer work of the scientific board. Some SB expenses such as the travel costs could be reimbursed by the NPO. Each SB member should devote a limited effort, e.g. 1 to 3 days per month.

The Executive Team would be employed. The money to cover its salaries would come from research project applications, the serious game licensing, consulting projects or the annual conference.

5.2.5 Business plan of the NPO

Figure 18 and table 9 details the expected expenses and revenues of the NPO for the 5 first years after creation.

The foreseen costs are:

- Personnel costs: They represent 58% of total costs. The salaries and related social taxes will highly depend on the location of the NPO. Taking illustrative figures, the total personnels costs (salaries + taxes) could be around 80 000 € / year for the CEO, 60 000 € / year for an admin staff, 80 000 €/year for a communication person, 80 000 €/year for a business developer, 70 000 €/year for an IT engineer. Some technical experts may be recruited later on when possible, for a total of 80 000 €/year. Temporary staff is also expected to be recruited, in particular for organising the annual conference. For simplicity, it is assumed that the remuneration for this staff will represent 20% of personnel costs.
- Overheads include fixed costs like office rents, insurance, telecoms, administrative costs, furniture, bank, IT infrastructure, communication materials. The amount will depend on the location of the NPO. It is assumed to amount to 75% of direct personnel costs.

- Other direct costs for members include workshops (5 000 €/workshop) and travel costs for the members of the Executive Team and Scientific Board. It is assumed that 2 workshops would be organised every year and that travel costs will represent an indicative 20% of direct personnel costs. They would have to be financed on the NPO budget.

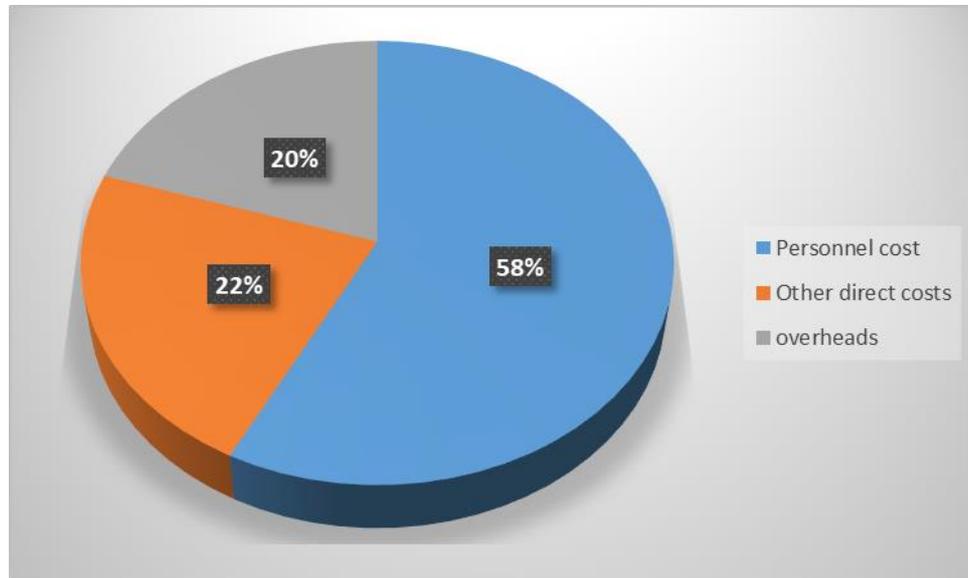


Figure 17: Representation of the % distribution of the total costs for the NPO

The revenue streams are assumed to be multiple:

- Membership fees will be requested: 1000€ for academics, 1 000€ for SMEs and NGOs, 5 000 € for large companies (from 500 to 5 000 employees) and 10 000€ for large companies over 5 000 employees , and 100€ for individuals (students, citizens).
- Sponsoring from large companies (which may be represented in the NBG) and philanthropic donations are also assumed.
- Direct subsidies should be sought. The amount depends on the country where the NPO will be located. It is assumed to range from 50 000 to 100 000 €/year.

The annual conference is assumed to last 2 days for around 150 participants. The cost depends on the location. A budget of 75 000 – 100 000€ is assumed. Conference fees will be fixed to 500 € for members and 750€ for non-members.

As regards consulting services and research grants acquired by the NPO, the NPO could retain 15% management fees for every consulting project it sells. It is assumed that a typical consulting project would last 2 months and could be sold 30 000 €/year. The work would be executed by some Members (taking 85% of the total price).

For the serious game, licence fees could be set to 300€/year and training sessions could be sold 2000€/day.

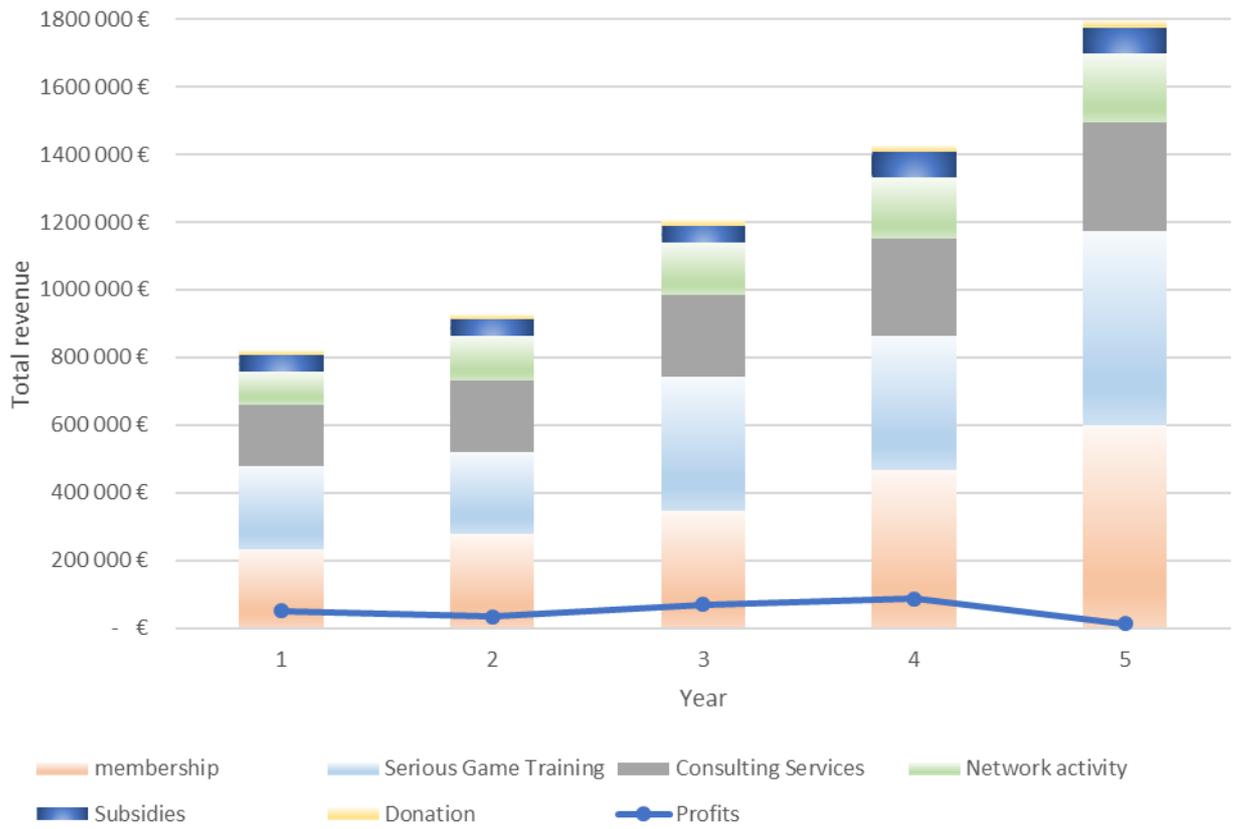


Figure 18: Expected 5-year Business projection for the Non-Profit Organisation

	Year 1	Year 2	Year 3	Year 4	Year 5
Non-Profit Organisation Revenues					
Consulting Services					
Consulting services (2 months)	30 000 €	30 000 €	30 000 €	32 000 €	32 000 €
Nb of consulting services	6	7	8	9	10
Total Revenues for Consulting services	180 000 €	210 000 €	240 000 €	288 000 €	320 000 €
<i>Including Management Fees for the NPO (15% total consulting Services)</i>	27 000 €	31 500 €	36 000 €	43 200 €	48 000 €
<i>Including subcontracting for Scientific Members (85% total consulting services)</i>	153 000 €	178 500 €	204 000 €	244 800 €	272 000 €
Serious Game Revenues					
Price of access fee of the SG	300 €	300 €	300 €	300 €	300 €
Price of a training session	2 000 €	2 000 €	2 250 €	2 250 €	2 500 €
Nb of SG access fees	150	150	200	200	250
Nb training sessions sold per year for training purpose	100	100	150	150	200
Total Revenues for Serious Game Training	245 000 €	245 000 €	397 500 €	397 500 €	575 000 €
Network activity revenues					
Annual conference entry fees - members	25 000 €	40 000 €	50 000 €	60 000 €	70 000 €
Annual conference entry fees - non-members	75 000 €	90 000 €	105 000 €	120 000 €	135 000 €
Workshops	- €	- €	- €	- €	- €
Nb participants annual conference - members (500 €/conference)	50	80	100	120	140
Nb participants annual conference - non-members (750€/conference)	100	120	140	160	180
Nb person attending the workshops	10	15	20	25	30
Subtotal for Network activity incomes	100 000 €	130 000 €	155 000 €	180 000 €	205 000 €
Annual membership revenues					
Universities / Research Centers	1 000 €	1 000 €	1 000 €	1 500 €	2 000 €
Individuals (students, citizens)	100 €	100 €	100 €	120 €	150 €
SMEs and companies <500 employees	1 000 €	1 000 €	1 000 €	1 250 €	1 250 €
Companies (from 500 to 5 000 employees)	5 000 €	5 000 €	5 000 €	5 500 €	5 500 €
Large companies (From 5 000 employees)	10 000 €	10 000 €	10 000 €	10 500 €	10 500 €
Non-for-Profit Organisation and NGOs	1 000 €	1 000 €	1 000 €	1 250 €	1 250 €
Nb of Universities / Research centers	25	25	27	27	30
Nb of individuals (students, citizens)	100	200	300	400	500
Nb SMEs and companies <500 employees	12	15	20	30	50
Nb Companies (from 500 to 5 000 employees)	12	12	12	12	13
Nb Large companies (From 5 000 employees)	12	15	20	25	30
Non-for-Profit Organisation and NGOs	7	7	9	9	11
Subtotal for annual membership revenues	234 000 €	277 000 €	346 000 €	465 750 €	597 750 €
Donations					
Moral and physical entities	15 000 €	15 000 €	20 000 €	20 000 €	25 000 €
Subsidies					
Public or private for workshops and conferences	50 000 €	50 000 €	50 000 €	75 000 €	75 000 €
Total Revenues	824 000 €	927 000 €	1 208 500 €	1 426 250 €	1 797 750 €
Non-Profit Organisation expenses					
Direct Personnel costs (per year)					
CEO	80 000 €	80 000 €	80 000 €	80 000 €	80 000 €
Administrative	60 000 €	60 000 €	60 000 €	60 000 €	60 000 €
Communication	80 000 €	80 000 €	80 000 €	80 000 €	80 000 €
Business developer	80 000 €	80 000 €	80 000 €	80 000 €	80 000 €
IT Engineer	70 000 €	70 000 €	70 000 €	70 000 €	70 000 €
Temporary staff (20% personnel cost)	74 000 €	74 000 €	74 000 €	74 000 €	74 000 €
Nb of CEO	1	1	1	1	1
Nb of administrative	1	1	1	2	3
Nb of communication	1	1	2	2	3
Nb of business developer	1	2	2	2	3
Nb of IT engineer	1	1	2	2	3
Nb of temporary staff	1	1	1	2	2
Subtotal for Personnel costs	444 000 €	524 000 €	674 000 €	808 000 €	1 098 000 €
Other direct costs (per year)					
Workshop (2/year)	10 000 €	10 000 €	15 000 €	15 000 €	20 000 €
Conferences organisation	50 000 €	50 000 €	60 000 €	60 000 €	60 000 €
Travel (20% of direct personnel cost)	88 800 €	104 800 €	134 800 €	161 600 €	219 600 €
Equipment	10 000 €	10 000 €	12 500 €	12 500 €	15 000 €
Other goods and services	15 000 €	15 000 €	15 000 €	15 000 €	15 000 €
Subtotal for events	173 800 €	189 800 €	237 300 €	264 100 €	329 600 €
Overheads (25% direct costs)					
Subtotal for overheads	154 450 €	178 450 €	227 825 €	268 025 €	356 900 €
Total costs	772 250 €	892 250 €	1 139 125 €	1 340 125 €	1 784 500 €
Profits	51 750 €	34 750 €	69 375 €	86 125 €	13 250 €

Table 9: Expected 5-year business plan for the Non-Profit Organisation

The table 9 represents the detailed Business Plan for the Non-Profit Organisation listing all the foreseen revenues and costs during the first 5 years of the organisation. It shows that the NPO would require 1 CEO, 1 communicator, 1 Business Developer, 1 administrative staff and 1 IT engineering for starting the company. The number of the staff is planned to grow in accordance to the revenues generated by the

different activities during these years. The Business plan includes incomes such as membership fees, conference organisation, donation and subsidies and activities of the foundation developed with the results of SIM4NEXUS and the new materials that will be developed by the different working groups associated with the Scientific Board, including Serious Game and consulting activities related to the nexus.

The foundation can have a positive turnover to cover all the expenses only if the goal of memberships, donations and consulting/training sessions are achieved during the first years of existence. Efforts should be made prior the launch of the NPO to recruit future members. The first obvious could be the Universities, partners and private companies involved in the SIM4NEXUS project as well as the project sisters and the stakeholders associated (nexus network). This could be reach with the help of the Nexus Business Group that would help to diffuse the existence and purpose of the NPO, to recruit new members and pre-sell Serious Game training sessions and consulting services.

The NPO can be associated with neighbouring projects such as Nexus Resource Platform or network Project Cluster to assess their community and use them as resources and network centres. Numerous exchanges between the different entities will profit to each other in a win-win way as each entity will approach the nexus by a different angle (for example the Nexus Resource Platform deals with the Water-Energy-Food Nexus in regions that are different from the ones targeted with SIM4NEXUS: Middle east and north Africa, Latin America and the Caribbean, Southern Africa, Niger Basin, Central Asia, South/Southeast Asia).

The NPO will face many challenges including risks that are common for all new companies' activities:

- **Commercial risks:** can we find client? Do they want what we offer? How to reach them? Is the pricing acceptable?
- **Operational risks:** can we deliver? At a cost which ensures profits to covers costs? What costs for developing improved versions of SG and SDMs?
- **Management risks:** Do we have enough cash? How to recruit talents?

The key general risk to find exploitation project leaders. The project leaders must take responsibility for the long-term exploitation. Sim4Nexus partners could position themselves in the different posts either in the executive board, the scientific board or the Nexus Business Group. This is needed to be define in the coming months before the end of the SIM4NEXUS project.

6 Synthesis and conclusions

SIM4NEXUS has many, highly inter-related components, diverse case studies which are not standardised, with variable involvement of different partners on variable scopes. A breath of knowledge has been generated. The key challenge for exploitation is to screen all this material and propose an adapted, coherent exploitation strategy.

The IPR management in SIM4NEXUS is very complex due to the very variable involvement of various, non-standard components, using different data sources and providing not-comparable results. The European Commission however imposes to exploit commercially the project results and promotes open

access / open data, as well as wide dissemination. The IPR management is really complicated by the high level of interdependency between the partner results.

This draft exploitation strategy recommends to create a Non-Profit exploitation (NPO) (in a potential legal form of a foundation) that would better exploit the outputs of the projects (Nexus scenarios and data on case studies, conceptual models, Nexus science, policy analysis methodologies) since they would benefit from being enriched by a large community at no cost and would support a large dissemination impact.

Setting up such a new activity is particularly challenging. It requires a skilled team to manage with excellence commercial, operational and administrative activities. Finding this team is critical to enable the exploitation of SIM4NEXUS. It should be ideally based on project partners but synergies with external partners may be sought.

The proposed structure for the NPO would involve an Executive Team that would manage and administrate the NPO and its members, a Scientific Board that would network all research teams active on nexus, modelling or serious game to monitor the latest advances and support the development of new international research collaborations, and a Nexus Business Group that would link the scientific activities with end-user requirements. Synergies with sister projects DAFNE and MAGIC may be envisaged to pool a larger mass of data. A project leader must be found.

The newly structure would exploit the serious game either with free access and with paid access. The expected revenues are limited and will be added to the operating expenses and revenues of the NPO, while effort is required to develop new versions for premium applications and delivering the serious games requires skills.

The following action plan is proposed:

- This deliverable proposes a draft exploitation strategy for discussion at Month 30. From now, partners have 6 months to decide if they want to be part of the exploitation possibility. Meanwhile, the IP issue should be resolved.
- By the next Go / No Go milestone (MS27) at Month 36, the technical, IP and human resources questions should be answered for a properly informed decision-making on a) the decision to exploit the results in the proposed way, b) the related action plan by the project end and c) the project leader (both a specific person and his/her employing organisation) responsible for creating the NPO.
- From Month 36 to Month 48, the project leader should take all actions to enact the exploitation plan, in particular to create the NPO legally. All costs should be estimated according to its location agreements should be signed with all project partners willing to participate, all data should be centralised for future operations, the scientific programme should be drafted, the annual conference should be prepared, potential sponsors and donators should be approached, the serious game development should be finalised.

Annex 1: Top ranked European Universities in Environmental Studies & Earth Sciences

<https://www.bachelorsportal.com/disciplines/117/environmental-studies-earth-sciences.html>

81 European Universities

Universities	Location	Best Global Universities Rankings (2018) Environment & Ecology
Wageningen University and Research	Wageningen, Netherlands	2
ETH Zurich - Swiss Federal Institute of Technology	Zürich, Switzerland	4
University of Oxford	Oxford, United Kingdom	8
Imperial College London	London, United Kingdom	11
Stockholm University	Stockholm, Sweden	17
University of Copenhagen	Copenhagen, Denmark	18
University of Cambridge	Cambridge, United Kingdom	20
Swedish University of Agricultural Sciences	Uppsala, Sweden	22
Aarhus University	Aarhus, Denmark	23
The University of Exeter	Exeter, United Kingdom	25
University of Montpellier	Montpellier, France	26
Lund University	Lund, Sweden	32
University of Helsinki	Helsinki, Finland	39
Utrecht University	Utrecht, Netherlands	41
University of Leeds	Leeds, United Kingdom	42
University of Zurich	Zürich (Kreis 1), Switzerland	44
Vrije Universiteit Amsterdam	Amsterdam, Netherlands	44
Sorbonne University	Paris, France	49
Georg-August-Universität Göttingen	Göttingen, Germany	49
University of Bern	Bern, Switzerland	52
The University of Edinburgh	Edinburgh, United Kingdom	55
University of East Anglia	Norwich, United Kingdom	56
Université Grenoble Alpes	Grenoble, France	58
Uppsala University	Uppsala, Sweden	61
University of Sheffield	Sheffield, United Kingdom	62
University of Barcelona	Barcelona, Spain	63

Universities	Location	Best Global Universities Rankings (2018) Environment & Ecology
University of Reading	Reading, United Kingdom	65
Lancaster University	Lancaster, United Kingdom	67
University College London (UCL)	London, United Kingdom	68
University of Vienna	Vienna, Austria	68
Ghent University	Gent, Belgium	70
University of Oslo	Oslo, Norway	71
University of Aberdeen	Aberdeen, United Kingdom	72
University of Gothenburg	Göteborg, Sweden	75
University of Antwerp	Antwerpen, Belgium	80
University of Bristol	Bristol, United Kingdom	82
Umea University	Umeå, Sweden	85
Autonomous University of Barcelona	Barcelona, Spain	94
University of Freiburg	Freiburg, Germany	94
University of Basel	Basel, Switzerland	96
Plymouth University	Plymouth, United Kingdom	99
University of Amsterdam	Amsterdam, Netherlands	100
University of Lisbon	Lisbon, Portugal	105
University of Southampton	Southampton, United Kingdom	106
AgroParisTech - Institut des Sciences et Industries du Vivant et de l'Environnement	Paris, France	108
Delft University of Technology (TU Delft)	Delft, Netherlands	109
Technical University of Munich	München, Germany	110
University of York	York, United Kingdom	114
Ecole Polytechnique Fédérale de Lausanne	Lausanne, Switzerland	116
University of Birmingham	Birmingham, United Kingdom	121
Technical University of Denmark (DTU)	Copenhagen, Denmark	123
University of Lausanne	Lausanne, Switzerland	125
University of Groningen	Groningen, Netherlands	128
Université Montpellier 3 Paul Valéry	Montpellier, France	130
University of Bergen	Bergen, Norway	130
University of Porto	Porto, Portugal	133

Universities	Location	Best Global Universities Rankings (2018) Environment & Ecology
Humboldt University Berlin	Mitte, Germany	135
University of Girona	Girona, Spain	135
Aix-Marseille University	Marseille, France	140
University of Tartu	Tartu, Estonia	142
Norwegian University of Life Sciences (NMBU)	Ås, Norway	143
Norwegian University of Science and Technology (NTNU)	Gjøvik, Norway	144
The University of Manchester	Manchester, United Kingdom	145
University of Potsdam	Potsdam, Germany	145
Charles University	Prague, Czech Republic	147
University of Bayreuth	Bayreuth, Germany	152
University of Bonn	Bonn, Germany	156
University of Tübingen	Tübingen, Germany	159
Goethe University Frankfurt am Main	Frankfurt am Main, Germany	159
Radboud University Nijmegen - Summer School	Nijmegen, Netherlands	161
UIT the Arctic University of Norway	Tromsø, Norway	165
Ludwig-Maximilians-University (LMU) Munich	München, Germany	166
KU Leuven	Leuven, Belgium	168
Université de Rennes 1	Rennes, France	169
University of St Andrews	St Andrews, United Kingdom	174
BOKU University of Natural Resources and Applied Life Sciences	Vienna, Austria	176
Bangor University	Bangor, United Kingdom	183
University of Kiel	Kiel, Germany	183
University of Paris Sud	Orsay, France	187
Universidade de Aveiro	Aveiro, Portugal	190
Karlsruhe Institute of Technology (KIT)	Karlsruhe, Germany	197

Annex 2: List of European Schools/Universities in Environmental science degrees

(<https://www.educations.com/search/institutes/environmental-science-europe/c232-d58>)

57 Schools/Universities

- alto University (FI)
- Abertay Unviersity (UK)
- Askham Bryan College (UK)
- Avans University of Applied Sciences (UK)
- Business Academy Aarhus (DK)
- Ca' Foscari University of Venice (IT)
- Swedish University of Agricultural Sciences (SE)
- VAH Vilentum University of Applied Science (NL)
- Centrale Nantes (FR)
- Chalmers University of Technology (SE)
- Coventry University (UK)
- Delf Univerity of Technology (NL)
- Ecole Polytechnique (FR)
- Faculty of Science – Stockholm University (SE)
- Franklin University Switzerland (CH)
- Geneva Business School – Geneva (CH)
- Glasgow Caledonian University (UK)
- Hanze University of Applied Sciences Groningen (NL)
- HZ University of Applied Sciences (NL)
- Insitute for Housing and Urban Development Studies HIS Erasmus Rotterdam University (NL)
- Leiden University (NL)
- Leuphana Univeristy of Lüneburg (DE)
- Linköping University (SE)
- Linnaeus University (SE)
- Maastricht School of Management (NL)
- Mälardalen University (SE)
- Palacky Univerity Olomouc (CZ)
- Paris School of Economics (FR)
- RWTH International Academy (DE)
- School of Economics and Business in Sarajevo (BA)
- SLU (Swedish University of Agricultural Sciences (SE)
- Szent Istvan Unviersity (HU)
- American University of Paris (FR)
- The Catholic University of the West (UCO)(FR)
- Univeristy of Edingburgh (UL)
- Universidad Autonoma de Madrid (ES)
- Universidad de la Laguna (ES)
- Université Côte d'Azur (FR)
- University of Antwerp (BE)
- Unviersity of Birmingham (UK)
- University of Camerino (IT)
- University of Devrecen (HU)
- University of Dundee (UK)
- University of Exeter (UK)
- University of Groningen (NL)
- University of Manchester (UK)
- University of Nottingham (UK)
- University of oviedo (ES)
- University of Southampton (UK)
- University of Stirling (UK)
- University of Strathclyde Business School) (UK)
- University of Sussex (UK)
- University of Warwick (UL)
- University of Westminster (UK)
- Vilious Gediminas Technical University (LI)
- Vrije Universiteit Amsterdam (NL)
- Vrije Universiteit Brussel (BE)
- World Maritime University (SE)

Annex 3: List of European Schools/Universities in Agriculture

<https://www.educations.com/search/institutes/agriculture-europe/c233-d58>

16 Schools/Universities

- Askham Bryan College (UK)
- Bern University of Applied Sciences (CH)
- Business Academy Aarhus (DK)
- CAH Vientum University of Applied Sciences (NL)
- HAS University of Applied Sciences (NL)
- HIS Institute for Housing and Urban Development Studies Rotterdam University (DK)
- Latvia University of Agriculture (LV)
- Swedish University of Agricultural Science (SE)
- Szent Istvan University (HU)
- University of Edinburgh (UK)
- Universidad Autonoma de Madrid (ES)
- University Cattolica del Sacro Cuore (ES)
- University of Debrecen (HU)
- University of Nottingham (UK)
- VHL University of Applied Science (NL)
- Vrije Universiteit Brussel (BE)

Annex 4: List of European Schools/Universities in Biology

(<https://www.educations.com/search/institutes/biology-europe/c729-d58>)

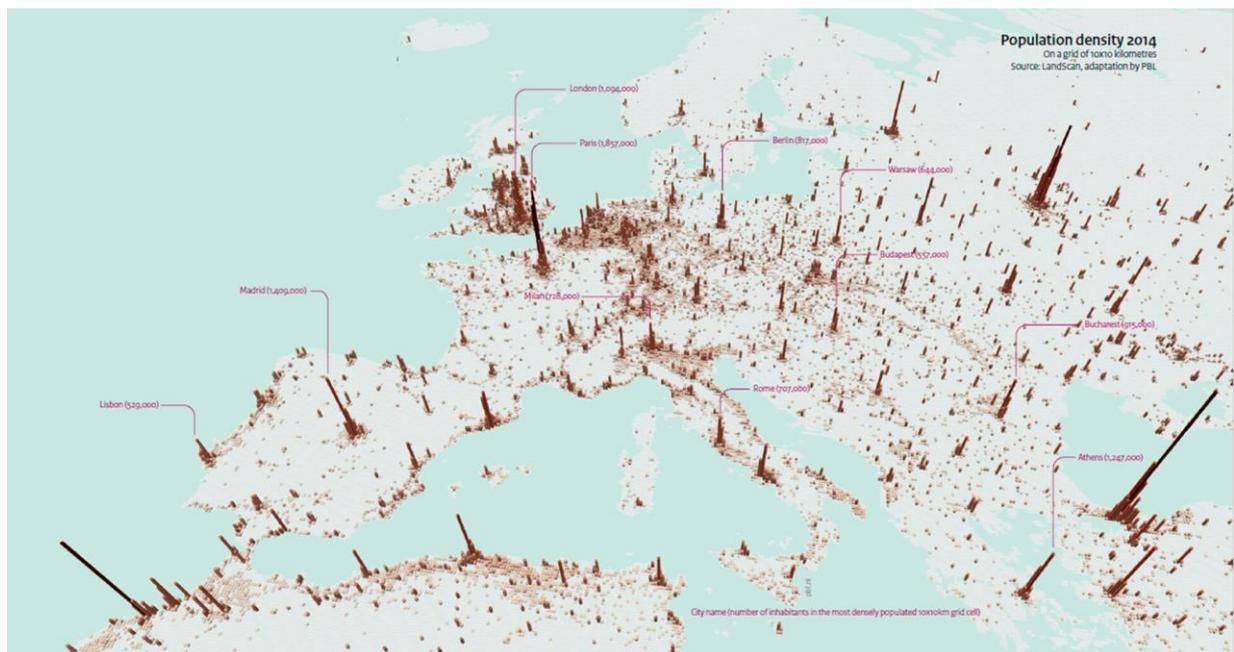
46 Schools/Universities

- Aalto University (FI)
- Abertay University (UK)
- Bahcesehir University (TR)
- Business Academy Aarhus (DK)
- Cardiff University (UK)
- Coventry University (UK)
- Faculty of Science Stockholm University (SE)
- Glasgow Caledonian University (UK)
- HAN University of Applied Sciences (Hogeschool en Nijmegen (NL)
- Hector Fellow Academy (DE)
- Karolinska Institutet (SE)
- Leinden University (NL)
- Linköping University (SE)
- Linnaeus University (SE)
- Lithuanian Sports University (LT)
- Peter the Great St Petersburg Polytechnic University (RU)
- Sabanci University (TR)
- SLU – Swedish University of Agricultural Sciences (SE)
- The University of Cambridge (UK)
- The University of Edinburgh
- Universidad Autonoma de Madrid (ES)
- Universidad de la Laguna (ES)
- Universitat Autonoma de Barcelona (ES)
- Université Côte d’Azur (FR)
- University of Antwerp (BE)
- University of Birmingham (UK)
- University of Camerino (IT)
- University of Debrecen (HU)
- University of Dundee (UK)
- University of Exeter (UK)
- University of Gronongen (NL)
- University of Manchester (UK)
- University of Nottingham (UK)
- University of Pavia (IT)
- University of Pisa (IT)
- University of South Wales (UK)
- University of Southampton (UK)
- University of Stirling (UK)
- University of Sussex (UK)
- University of Tampere (UK)
- University of Warwick (UK)

- University of Westminster (UK)
- Vrije Universiteit Amsterdam (NL)
- Vrije Universiteit Brussel (BE)
- Vitautas Magnus University (LT)

Annex 5: European Urban Landscape

The urban landscape of Europe is characterised by a large diversity of small, medium-sized and large cities. Compared to other parts of the world, many urban regions in Europe have a polycentric structure where multiple towns and cities are in close proximity to one another → potential clients for the SIM4NEXUS exploitation strategy



Source: PBL Netherlands Environmental Assessment Agency: Cities in Europe, Facts and figures on cities and urban areas, 2016