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

D5.9 - PRACTICAL GUIDANCE ON THE APPLICATION OF SERIOUS GAME IN PARTICIPATORY PROCESSES UNDER REAL LIFE CONDITIONS

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THE EXECUTIVE SUMMARY IS QUITE GENERAL, IDENTICAL TO THE ONE OF D5.8 AND DOES NOT SUFFICIENTLY DESCRIBE THE CONTENT OF THE DELIVERABLE. FOR EXAMPLE, THE SUMMARY COULD MENTION THE DIVERSE TYPES OF USE OF	CHANGED THE EXECUTIVE SUMMARY TO REFLECT THE FACT THAT IT IS MORE ORIENTED AT PROVIDING A GENERAL DESCRIPTION OF THE PARTICIPATORY PROCESSES PROMOTED BY THE GAME. SEE NEW PARAGRAPH.

THE SERIOUS GAME AND SAY THAT THE DELIVERABLE PROVIDES INSTRUCTIONS FOR EACH OF THEM.	
THE COMPLEMENTARITY OF THIS DELIVERABLE AND D5.8 MUST BE CLEARLY MENTIONED IN THE SUMMARY, THE SUMMARY SHOULD ALSO REFER TO THE D5.8. SOME ELEMENTS OF D5.8 ARE USEFUL FOR NEW USERS.	ADDED TO EXECUTIVE SUMMARY THE FOLLOWING: “THIS DELIVERABLE IS COMPLEMENTARY TO DELIVERABLE D5.8 “REPORT ON THE APPLICATION OF THE SERIOUS GAME FOR SECONDARY AND UNIVERSITY EDUCATION AND FOR SUPPORTING DECISION MAKING, FOR CIVIL SOCIETY/RAISING AWARENESS AMONG CITIZENS ".
THE PURPOSE OF THE DELIVERABLE IS NOT FULLY CLEAR. IF IS IT TO GUIDE NEW USERS OF THE GAME, SECTION 2.1. (INDIVIDUAL BASED PARTICIPATORY PROCESS) NEEDS TO BE MORE PRECISE; OTHER SECTIONS ARE CLEAR. IF THE PURPOSE OF THE DELIVERABLE IS A GENERAL DESCRIPTION OF THE APPLICATIONS, SECTION 2.1. IS ACCEPTABLE.	THE PURPOSE OF THE DELIVERABLE IS TO PROVIDE A GENERAL DESCRIPTION OF THE APPLICATION. WE THEREFORE DO NOT ADD ANY FURTHER MODIFICATIONS TO THAT PART.
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Executive summary

This deliverable aims at providing a general description of the participatory processes the SIM4NEXUS Serious Game has used to connect to an audience.
First, the application of individual, team based, or facilitator centred participatory processes has allowed the game to make the complex subject of the Nexus interactions between Water, Energy, Land, Food, and Climate more accessible to a general audience.
A secondary aim was also reached regarding the capacity of the system to allow transparent and detailed analysis of the System Dynamic Model behind the Nexus for each case study to be useable as exploration tool allowing scientists and engineers to participate by exploring the model in a detailed fashion.
Finally, the ability to experiment with different combinations of policy cards and compare their effects in different contexts give the Serious Game the ability to be a ground-breaking tool for training policy makers and make them find a cross-sectorial solutions to the Nexus problems.
This deliverable is complementary to deliverable D5.8 “Report on the application of the serious game for secondary and University education and for supporting decision making, for civil society/raising awareness among citizens”.

Changes with respect to the DoA

A two weeks delay was allowed due to the fact several games were developed, and we needed to wait for the system dynamic modelling teams to finish some of the late case studies in order to finish the latest games and then write the report.

Dissemination and uptake

This deliverable is aimed at the Commission.

Short Summary of results (<250 words)

The SIM4NEXUS Serious Game is a new type of learning tool that can allows a non-specialised audience, as well as scientists, engineers and policy makers to explore how different policies can impact the Nexus over multiple sectors such as Water, Energy, Land, Food, and Climate. Multiple playing events took place with different types of stakeholders and results were extremely positive regarding not only the capacity of that type of tool to reach different audiences but also its capability to accommodate different learning goals. It is likely that this kind of tool will be reused in the context of conferences to organise competitive events, as well as an online training system suitable for a wide audience. The most striking thing about this type of Serious Game is that it has a lot of potential in the sense that it facilitates the gathering stakeholders from multiple backgrounds and encourage them to think in a cross-sectorial manner to solve the nexus problems.

Evidence of accomplishment

See playable game on Sim4nexus web site at
https://www.sim4nexus.eu/page.php?wert=SeriousGame

1 Introduction

The Sim4nexus Serious Game is rich in information. Participants can freely discover characteristics of the region(s) defined by the case study, analyse the behaviour of the model down to every single variable, and explore the effects of applying various combinations of policy cards to the nexus. The possibilities are quite numerous from a design point of view, and that allows the game process to be adapted to the audience and the learning goal.

Because the game can be played from a web browser, one can organise individual playing sessions, or team based competitive events with it, or even a virtual interactive demonstration going through an online facilitator.

The flexibility of the game also allows different types of events by restricting access to policy cards. It becomes possible to emulate a stakeholder from one Nexus sector only having only access to water policy cards, or energy policy cards. It is also possible to give a player the ability to use policy cards from both the water and the energy sector for example to show simple cross sector dynamics. Finally, one can allow players to combine policy cards from all five Nexus sectors simultaneously to try out more complex cross sector combinations.

The ability to play the game on a case study with a simple model like Azerbaijan, and then later to play with a more complex one like Latvia or Greece introduce the ability to compare how some strategies will work great for one country and not so well for another.

One can also design the game around the ability to compare actions at the regional and national level. The participants can then find optimal ways of saving resources by only targeting some specific regions with a given policy instead of applying the same policy everywhere.

Finally, the game can focus on pure exploration with unlimited resources (just trying the combinations of policy cards that lead to the highest Nexus health score) or on a limited budget type of approach so that players have to choose only a limited number of policy cards every round and therefore have to maximise effect with scarce resources.

This report is structured in 6 subsequent Chapters as follows:

Chapter 2 describes the type of participatory event can be either individual, team based, or facilitator centred.

Chapter 3 describes participatory events based on different sets of policy cards.

Chapter 4 describes participatory events based on single or multiple case studies.

Chapter 5 describes participatory events based on regional and national scopes.

Chapter 6 describes participatory events based on different strategies for resource allocation.

Chapter 7 contains the conclusions and recommendations.

2 Participatory processes

The participatory event can be either individual, team based, or facilitator centred.
In the individual participatory process, the participants can directly interact with the game by themselves on their individual interface.
In the team based participatory process, playing teams have to compete against each other via each team representative.
In the facilitator centred process, all players have to vote for changing the game input and go through one facilitator so that he applies the agreed policy decisions in one common game interface visible for all in a virtual conference room.
Depending on the time constraints, the serious game can consist in one game session that concentrates on one case study, or otherwise be divided into multiple game sessions that introduce different case studies in order of increasing complexity.

2.1 Individual based participatory process

Each participant can play the game from their own web browser. This allow a great deal of flexibility as in this mode, the game can be played unsupervised - no facilitator is required and the players can try the game remotely from anywhere.
Because each case study has its own set of ordered questions that players can try to answer, no external help is needed.

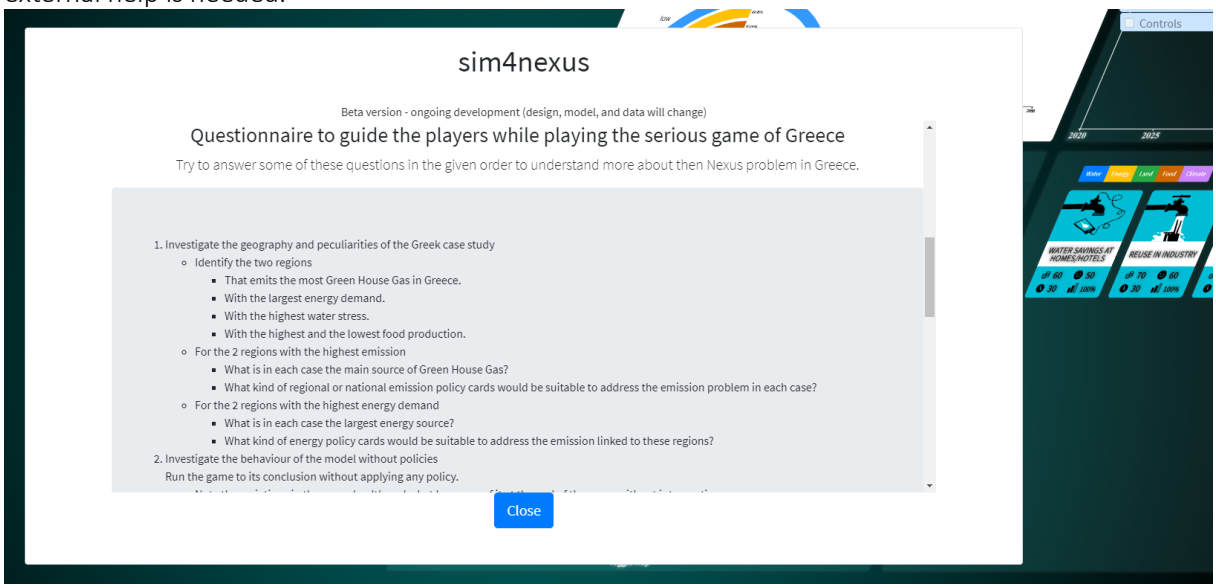


Figure 1. Ordered set of questions to explore appearing in the game interface to help the player to understand the case study

There is a high ranking table of all solutions for all games played, that enable the player to see how their own solution is ranked as long as he is signed in in the system with his own user name, and this enables competitive playing.

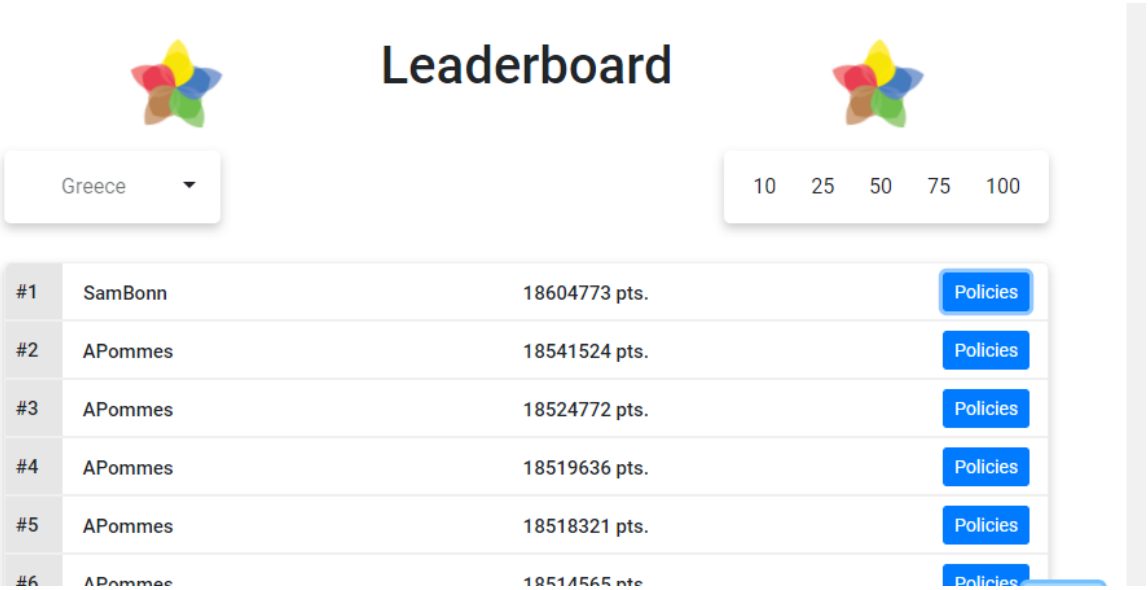


Figure 2. Ranking score table – folded view

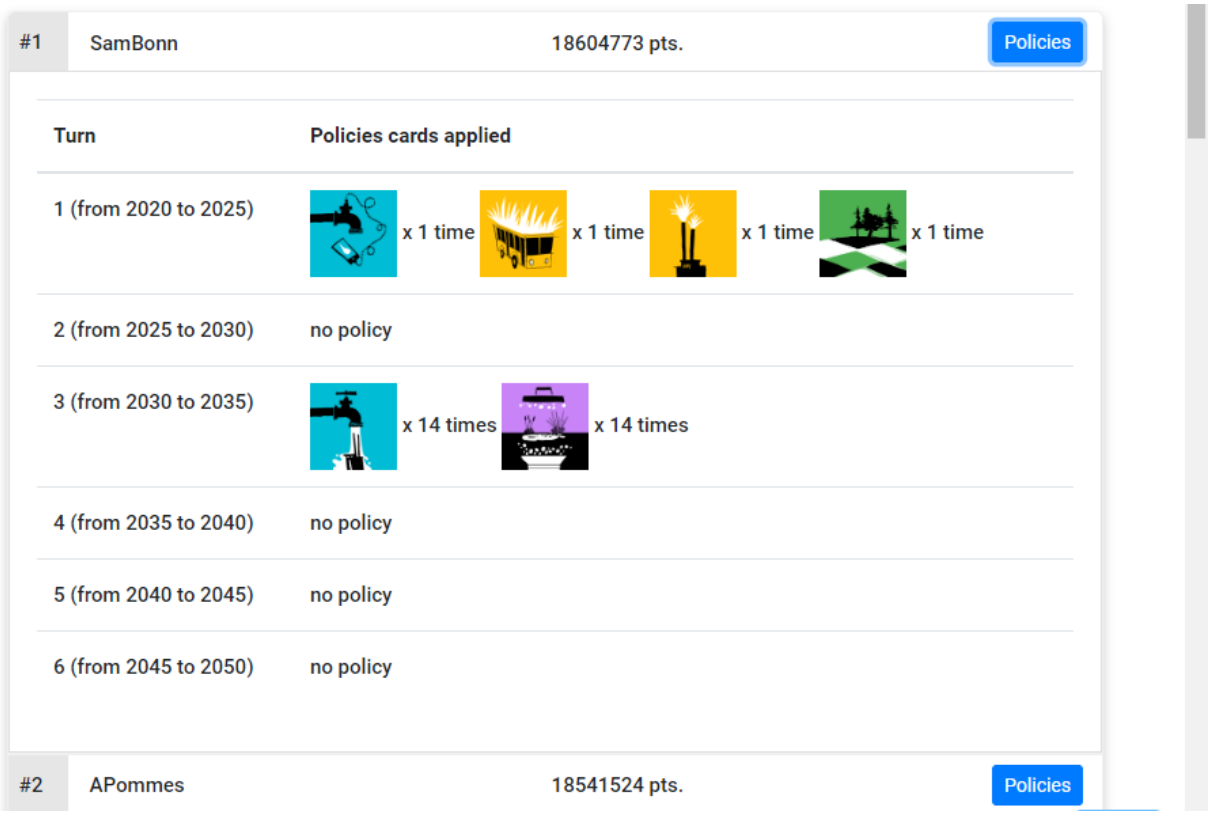


Figure 3. Ranking score table – detailed view for one solution with list of policy cards applied in each game round.

This individual based participatory process allows a wide range of events to be organised in multiple settings.
For example, a remote unsupervised themed game that can be played by hundreds of participants over several weeks.
Or an e-sport competition taking place during a conference where participants compete in a tournament.

2.2 Team based participatory process

In a real or virtual classroom type of setting, multiple teams can compete against each other when trying to answer specific questions about a case study that lead to solving some sort of multi-optimisation problem e.g. minimise costs while maximising Nexus health. This requires some sort of supervision where a facilitator group participants into teams, names a team representative that will enter the group decisions from his laptop, and interact with all teams so as to guide the session. See the following extract of the guidance for participants for the SIM4Nexus Training event that took place on the 13th of May 2020 - Greece Case Study – Zoom Meeting – 10:00 – 12:30 CET.

Table 1. Extract of game guidance given to facilitators – Zoom meeting – 3rd of June 2020 - Greece Case Study – Zoom Meeting – 3:30pm – 17:30pm CET

Part 4 – Game! *45 mins*	Breakout rooms – 6 teams *Isabella to activate the breakout rooms.* Each team plays to achieve the goal of overall best nexus health, competing against other teams – Let's compete and see who wins! *With 5 mins left, activate a reminder that will pop up in Zoom to say there is 5 mins left.* *Isabella closes the breakout rooms after 45 mins and we all come back to the main room.*
Part 5 – Debriefing *25 mins*	Come back from breakout rooms to main room The winning team Facilitator shares screens, look at who won and describe strategy, and 1-2 other teams give a quick overview of their strategy. Discussion: How is this useful in real life? Closing – Thank you! Feedback survey sent in Chat and post-session email

2.3 Facilitator centred participatory process

In this type of game session, all participant stand in a common real or virtual space and can see the facilitator game screen and communicate with him. See the following extract of the guidance for participants for the SIM4Nexus Training event that took place on the 13th of May 2020 - Greece Case Study – Zoom Meeting – 10:00 – 12:30 CET.

Table 2. Extract of game rules given to participants – Zoom meeting - 13th of May 2020 - Greece Case Study – Zoom Meeting – 10:00 – 12:30 CET

Game Rules In order to successfully play the game and take part in the training, you will need:

1. Create an account and login to play the game. Use this link https://seriousgame.sim4nexus.eu/sim4nexus-LoginPage.html click sign up and create Username: FirstName LastName and login

2. A stable internet connection, sound, video and microphone.

3. Google Chrome, to which the Sim4Nexus game is adjusted and possibly a mouse.

4. Background information on the case study, read here before the game.

5. For the playing round, you will be automatically assigned into 3 groups consisting of participants and 1 facilitator, which will occur via Zoom breakout rooms. You will have time for discussion and play.

6. For this session, we recommend the facilitator and 1 participant play the game, with all other participants watching on the shared screen of the facilitator. This means, the group discusses the cards to play and the facilitator and identified participant play the chosen cards on their own computers, while the others watch.

7. At the end of the game the facilitator will click FINISH, whereas the identified participant should click “Close” to keep the game open with the policies you have played for viewing and discussion. That way, the score from the facilitator can go to the leaderboard, and the participant can share the screen to show the results during the discussion period.

8. During the game round or feedback session, you can use the Zoom Chat function to write questions which the facilitators will answer.

9. Kindly note that since the Greece case study has many parameters due to the regional and national scales, the game might react slowly to clicks and turns. Please allow a few seconds between each click to view results.

3 Games based on different sets of policy cards

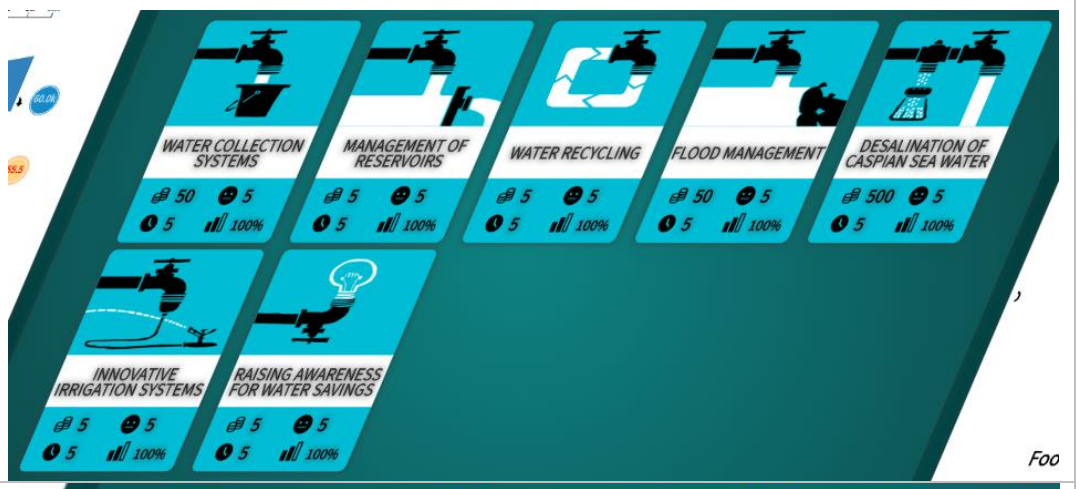
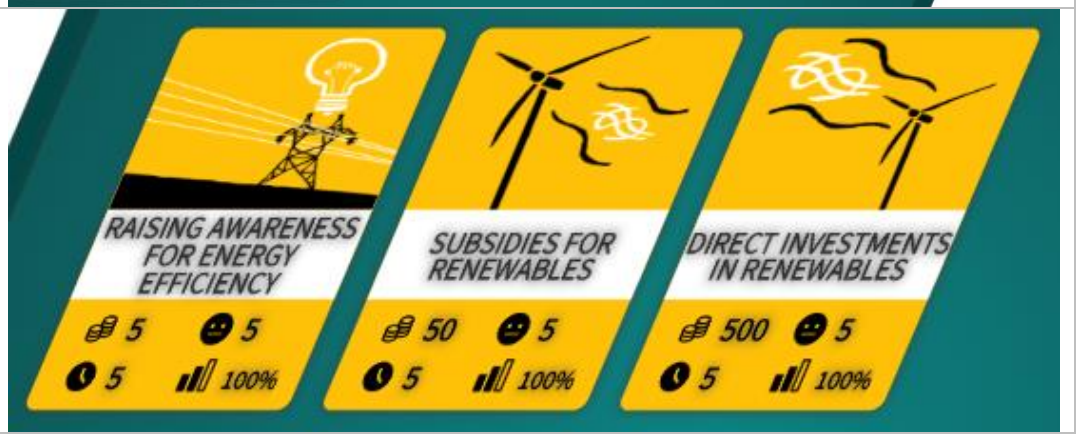
Changing the types of policy card a participant can have access to can completely alter the view a participant can have on a problem and its perceived solution.
For example, only having access to Land policy cards centring on improving management of land resources and focussing mainly on carbon capture policy cards as might not be enough to reach a climate carbon emission goal – proving the limitation of silo thinking.
On the other hand, a combination of "cross-silo" changes in agricultural practices, combined with a limitation of Water loss due to the adoption of new irrigation techniques, as well as an increase in use of renewable energies and a decrease of oil based energy generation might reduce very significantly Green House Gas emissions.
A similar approach was taken in the context of Azerbaijan case study where participants were only allowed to use policy cards from two types of Nexus sectors in a first round, and then all of them in a second round – see the excerpt of the facilitator guidance in Table 3 as well as the list of policy cards by sector in Table 4.

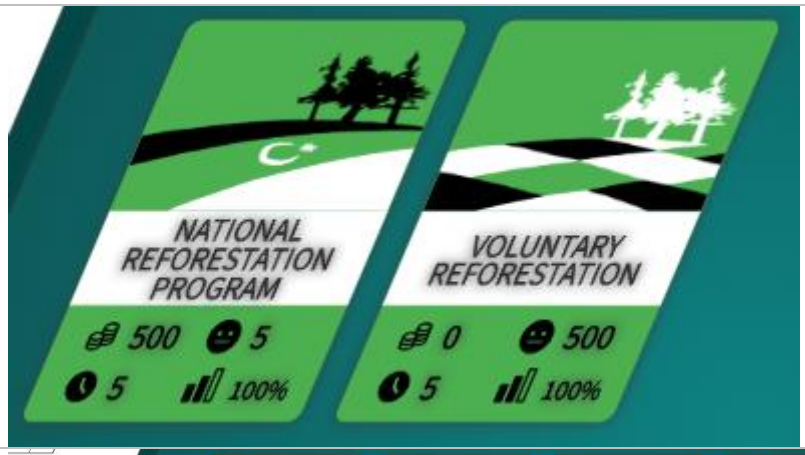
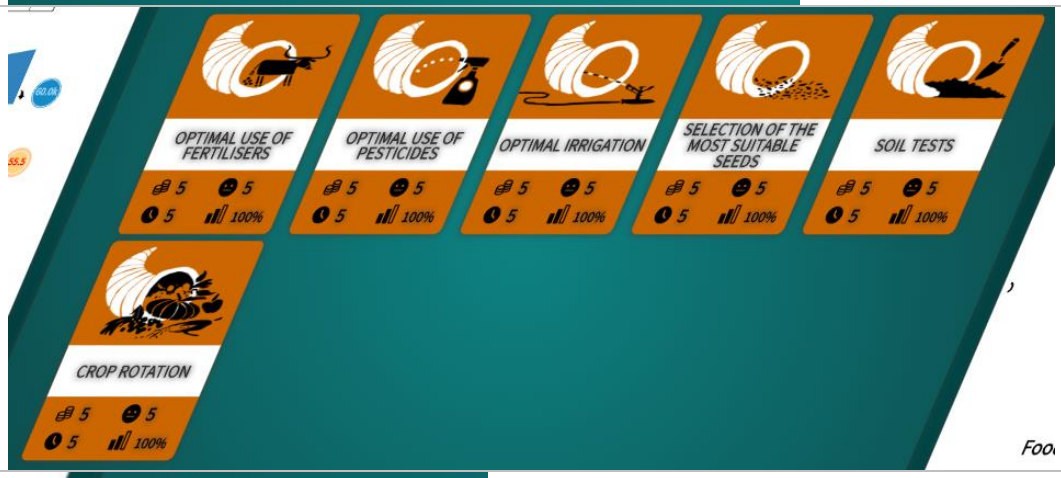
Table 3. Extract of game guidance given to facilitators – Zoom meeting – 23rd of April 2020 - Azerbaijan Case Study – Zoom Meeting – 10:00am – 12:30am CET

Round 2 – Two Sectors *45 mins*	**Part 1: Play!** Open New Tab Online + Breakout Rooms on Zoom *15 mins to play + 5 mins discussion – 20 mins total* *Remember each team member needs to play each turn on their own computer! 4 groups formed; participants can only play policy cards from the 2 sectors mentioned for each team. 1. Water and food 2. Energy and food 3. Land and food 4. Water and energy Team Discussion: Compare to Round 1 results – what changes do you see once you have implemented policy cards of 2 sectors? Back to main room **Part 2: Group Discussion** - One person per group shares what happened with implemented policies, compares to BAU – *12 mins (3 mins/group)* - Group exchange on lessons learned – *13 mins*
Round 3 – All Sectors *50 mins*	**Part 1: Play!** Open New Tab Online + Breakout Rooms in Zoom *20 mins play + 5 mins discussion – 25 mins total* 4 new groups formed with a player from each of the previous teams. Play all sectors and try to achieve best outcome (highest nexus health). *Remember each team member needs to play each turn on their own computer!

	Team discussion: Compare results to Rounds 1 and 2 – what changes do you see? Back to main room **Part 2: Group Discussion** - Questionnaire on Mentimeter – *5 mins* - Leaderboard: Final ranking reflection – Only the facilitator of each team clicks "Finish" in the game and then we can see the leaderboard who scored highest – discuss winning strategy – *11 mins* - Pre-Post Game comparison – 7 *mins*

Table 4. Sets of policy cards for each sector of the Nexus in the Azerbaijan case study

Water	
Energy	

Land	
Food	
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4 Games based on single or multiple case studies

Participants can either focus on a single case study e.g. only play Latvia, or have several game sessions dedicated to different case studies. There are two advantages to the later.

Firstly, an easier learning experience: participants approach the concept of Nexus by starting with a simple case study with just a few policy cards and a model of limited complexity e.g. Azerbaijan, and then play other cases studies of increasing complexity e.g. Latvia, and then Greece.

Secondly, the ability to compare different case study brings the capacity to identify how the same policies can lead to different results in a different context, and how the Nexus health scores can vary

between countries e.g. Latvia water nexus health score focuses on water quality while Greece water nexus health score focuses on water availability.

5 Games based on regional vs national scopes

Participants can focus on playing the game at the regional, or the national level, or both. It becomes possible for example to check if applying policy cards to a single region can have a sufficient impact at the national level to solve a problem such as lowering Green House Gas emissions under a required threshold. Participants can discover if it is possible to reach some goal at the national level while minimising costs by applying certain policies only in required regions. Comparing the difference of effects between regions of a given policy card also allows users to build a mental map of geographical sensitivity per region per policy. Thanks to the ability to change focus from the big picture to local specifics, users can build a national strategic plan that enhanced by the knowledge of local regional weaknesses and strengths. See the excerpt of the facilitator guidance in Table 5 used for the Greek case study that is composed of 14 interacting regions where combinations of local policies can have various effects at the national level.

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Table 5. Extract of game guidance given to facilitators – Zoom meeting – 13th of May 2020 - Greece Case Study – Zoom Meeting – 10:00am – 12:30am CET

Play time! *50 mins*	Break into Zoom Groups 3 groups formed, each group plays policy cards ONLY at the assigned scale: 5. National Scale **Note: Play all cards only at national scale. Compare BAU with the National changes, and look at some of the regions, if there has been any change.* 6. Regional Scale **Note: Play all water, land, energy and food cards only at regional scale, and climate cards at national scale (there is no regional climate policy cards). Also check to see what happens between the national and regional scale for any changes.* 7. National and Regional Scale **Note: Play all cards at all scales. Compare results with BAU, check how regions have changed.* Aim of the game: Increase overall nexus health. Back to group

6 Games based on different limitation strategies for resource allocation

The default way to play the game is to maximise the Nexus health score by trying different combinations of policies. When comparing two different combinations of measures, the one that results in the smallest monetary cost (expressed in tokens) and social cost wins. So overall, the

standard way of playing the game assume the player has no limitation on the resources available, and simply seeks to maximise health while minimising costs if possible.
Using exactly the same interface, we could change the overall dynamics of the game by imposing a strict five-year “budget” in terms of tokens and social cost for all participants. This would result in a game where participants can only afford a few chosen policies per game step and need to think deeply in term of what they can afford before commit to few policies they will deem as essential.

7 Conclusions and recommendations

The Sim4Nexus Serious Game has achieved its primary goal: making the complex subject of the Nexus interactions between Water, Energy, Land, Food, and Climate accessible to a general audience. It is also useable as a scientific/engineering exploration tool allowing the transparent and detailed analysis of the System Dynamic Model behind the Nexus for each case study. Finally, the ability to experiment with different combinations of policy cards and compare their effects in different contexts makes Sim4Nexus a highly innovative tool to help policy makers to learn about cross-sectorial approaches to solve the Nexus problems.
The next logical step, considering the flexibility of this type of tool, would be to try to apply it to other domains so as to develop a robust type of policy making training akin to the way surgeons or a pilots train to face emergencies.