

The JRC Scenario Exploration System - From Study to Serious Game

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Abstract

This report describes how the European Commission engaged in developing a serious game in order to engage stakeholders with foresight scenarios created to support the EU policy-making process. Four scenarios were created through a classic scenario building methodology (2X2 matrix), describing possible transitions towards a more sustainable future for the EU in 2035. These scenarios were used as a basis to design a serious game to help players engage in systemic thinking, discover and create alternative futures, and create novel engagements between stakeholders. The game was developed over a four month period and entailed running 10 prototyping sessions involving players from various services of the European Commission and other organizations (industry, civil society, academia, etc.). A system was developed to be able to harvest the stories created during the gaming sessions as a basis for de-briefing, further discussions and strategic analyses after the game. Ultimately, the game has demonstrated its usefulness and value for both players and organizers, and our reflections on the development process offer insights as to game design strategies and how educational outcomes and principles can be effectively mapped onto game mechanics.

Keywords: foresight, design, gaming

Introduction

While stakeholder-driven foresight studies are widely regarded as enriching experiences for participants, their strategic efficacy and impact over time is not as clear. During 2013-2014, the European Commission's Joint Research Centre (JRC) ran a foresight study, which resulted in a report *2035 - Paths Towards a Sustainable EU Economy - Sustainable transitions and the potential of eco-innovation for jobs and economic development in the EU eco-industries 2035* (Bontoux & Bengtsson 2015). To engage stakeholders who were not a part of this study and support the EU policy-making process, the JRC worked with the Hawaii Research Center for Futures Studies (HRCFS) and the Center for Postnormal Policy and Futures Studies (CPPFS) to develop a serious game—the JRC Scenario Exploration System (SES). The SES provides an experience for players to explore the study's alternative futures in an immersive way, which also fosters experimentation with new policy combinations and collaborative stakeholder dynamics.

The Foresight Study

The European Commission has long been aware that the societies and economies of the European Union (EU) are changing due to internal and external trends as well as global drivers. Indeed, the playing field for EU industries is changing rapidly, and this has serious implications for EU policy-making and research. As a consequence, a request for a long-term foresight study on “eco-industries” was formulated in 2012. Early in the research process, “eco-industries” were identified as crucial in ensuring that the transformation of the EU economy would lead to a sustainable future providing a high level of wellbeing and employment for EU citizens.

“Eco-industries” were broadly defined as “a stream of business activities across and within the entire industrial segment of society that encompass: “Green industries” - environmental industries; “Industries greening” – other industries adopting eco-innovations; “Eco-innovative solution providers” – R&D, new business models, organizational/social innovation, integrators”. The overall objective of the foresight study was “to develop 2035 visions for paths towards a sustainable EU economy by addressing the question: How can eco-industries (and other parts of the economy) best contribute to meeting the EU's sustainability, resource efficiency, growth, and jobs objectives?.

To reach the overall objective of the study, a very diverse group of about 40 experts from academia, industry, the consulting world, national public organizations, the European Commission, and others were led through a classic scenario building methodology over the course of five participative scenario-modelling workshops throughout 2013-2014. The first stage of the process consisted in developing a common understanding of “eco-industries” in a broad sense. Beyond the traditional “environmental industries” (e.g. water, waste, renewable energy...), this included the ‘greening’ of traditional industries as well as the “eco-innovative solutions providers”, i.e. all the actors generating the know-how necessary to “green” the economy (R&D, users of new business models, social innovators, etc.).

Once the participants felt comfortable with this concept of “eco-industries”, they were asked to identify the drivers of change expected to affect the evolution of these “eco-industries”. They were then led through a 2-stage prioritisation process:

first, people identified the drivers of change for which they did not know which way they would go (i.e. with the most uncertainty about their evolution); then people were asked to rank them in order of decreasing potential impact. The two drivers of change identified as both most uncertain and with most potential impact were selected to create four scenarios using the 2X2 matrix method. The two drivers used to build the four scenarios were societal values and fiscal framework. On the societal values axis, the two extremes were “Collaborative Society” and “Individualistic Society”. On the fiscal framework axis, the two extremes were “not supporting sustainability” and “highly supporting sustainability”. These two axes created four quadrants, each of which was used to develop a unique scenario describing possible transitions towards a more sustainable future for the EU in 2035. The scenarios were developed qualitatively on the basis of group brainstorming taking the previous discussions and reflections (in particular on the drivers) into account. Each scenario developed its own internal logic and coherence so as to maximise diversity of perspectives. The four resulting scenarios were subsequently named: Multiple Connected Initiatives (Scenario 1), Shared Circular Strategies (Scenario 2), Compact Green Innovation (Scenario 3), and Local Self-Reliance (Scenario 4). Figure 1 presents the basic scenario logic.

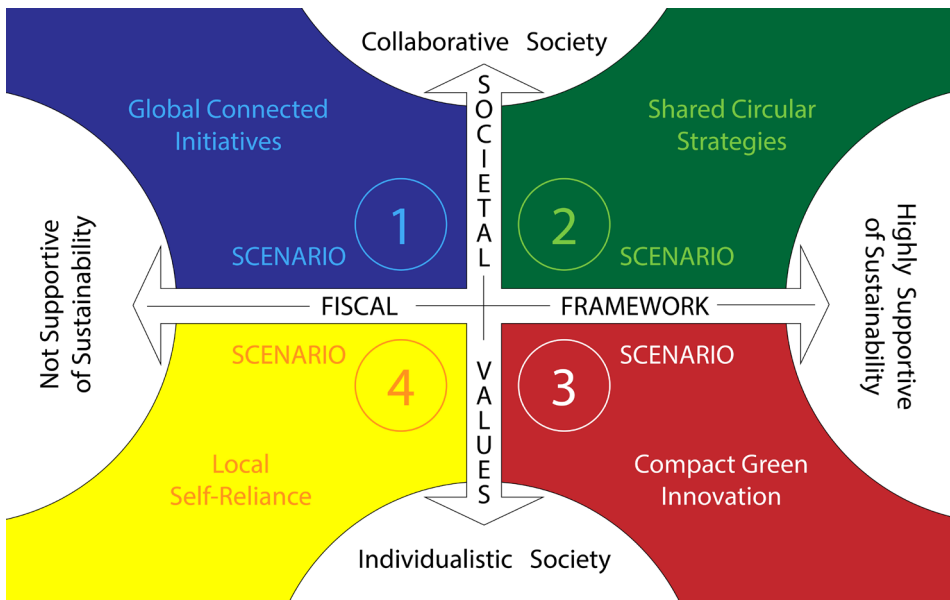


Figure 1. Scenario logic diagram used in the JRC foresight study 2035: Paths towards a Sustainable EU Economy

First, a set of key drivers and megatrends perceived to be very likely to affect all scenarios was analysed with respect to their likely impact by 2035, as described below.

“By 2035, the population of the world will probably reach 8.6 billion, with a stable ageing population in Europe but strong growth in Africa and parts of Asia. As the situation in emerging economies will also continue to improve, the global consuming class is expected to increase by 4

billion people, resulting in a strong demand for raw materials and energy. The first generation of “digital natives”, with its new approach to social contacts and mastery of digital technologies, will be in power. Global warming could very well reach 2°C, with the accompanying rise in sea level and damage to agriculture and infrastructures. Urbanisation will also continue unabated, leading to mega cities in the developing world and to more mid-sized cities in Europe. All this will happen in the context of continuing technological development (ICT, biotechnologies, materials, mobile technologies, sensors, etc.) that will lead to a hyperconnected world.”

A summary of two of the four scenarios is included below, and the final scenarios as well as narratives developed for each are available in the final report (Bontoux & Bengtsson, 2015).

Scenario 2 (Shared Circular Strategies) describes a world in which a strong collaborative ethos has emerged as a consequence of traumas created by catastrophic climate change. Society wants to survive. Solidarity mechanisms are strong and preoccupation with sustainability has generated a lot of social innovation that, in turn, has transformed European societies radically. In this top-down world, public authorities invest in large infrastructure projects for sustainable development. Integration of systems across society and the economy has made Europe very resource efficient. Industrial symbioses are the norm. Here, the local level is not so much a source of initiatives but more a level of implementation for grand, EU-wide plans. However, the overarching objectives are adapted to local specificities to fit well in the diverse European local contexts.

Scenario 4 (Local Self-Reliance) describes an individualistic world in which governance at EU and national levels is weak and powerful interest groups have created niches of influence. This gives more room to local levels of government. As average income levels have fallen, social protection systems have been eroded and the middle class has shrunk. Under external pressures, macroeconomic governance has become more integrated at EU level. The erosion of social protection systems also chipped away at citizens’ respect for the ‘State’. People consider that they have to rely on themselves more, with the result that they feel they need government less. Inequalities increase and powerful ICT platforms make direct democracy (and self-help) increasingly attractive, keeping governments in check but giving a greater role to the levels of government that are perceived to be closer, such as city and regional authorities. These have their hands full with managing disputes between self-centred citizens who want to have it all their own way. Many people may have a global outlook on the state of the environment but they care more about their own well-being and their own immediate environment than their country, Europe or people further afield. It is a ‘live and let live’, pragmatic and flexible society in which private interests dominate.”

Taking a systemic approach to the economic system, the study also looked at drivers for greater sustainability and resource efficiency that could ultimately enable

a sustainable transition of all industries, while addressing themes that cut across all industries, such as demand and behaviour, and the integrating and infrastructure effect of eco-industries. The study was successful in generating recommendations for EU policies and research to help set the EU economy on a path towards sustainable development. The study was also successful in bringing about a common systemic understanding of “eco-industries”, and a common intellectual basis for building a shared vision of a sustainable future for the EU.

From Study to Game

As a conduit for engaged learning, training, and dynamic content delivery, simulation gaming has a long history of development and usage in various fields and disciplines, including foresight (Popper 2008). Alongside the increasing ubiquity of mobile and online gaming platforms, a renaissance of tabletop and card-based gaming systems underlie the rise of “Serious Games” as a tool for research engagement and dissemination (Abt 1987). With the availability of craft design and production platforms, the growth of custom gaming systems has reignited an interest in applying gaming to foresight research, especially as this approach broadly supports “*embodied*” learning (Inayatullah, 2013, p. 3).

At its core, embodied learning provides an opportunity to play-test real-world dynamics, and when deployed as an experimental (in the context of a lab-approach) tool, games can create spaces for novel insights to emerge. As Valkering et al. note:

Simulation games [...] can serve both as an analytical tool to gain insight into complex issues (gaming as a ‘laboratory’) as well as a learning tool for participants offering various forms of support. Following the gaming as a laboratory metaphor, simulation games may lend themselves to the development of scenarios in which societal responses—and hence, environment-society interactions, discontinuity, and surprise—are better represented (Valkering et al., 2012, p. 368).

Furthermore, serious games allow for the inclusion of play in content delivery and research dissemination, which is to say that serious games ultimately aim to make learning and research dissemination “fun”, which is a key asset for organizations seeking innovative strategies and tactics to foster impactful change. As Wenzler and Chartier observe:

To ensure sustainable success, organizations need to create a learning environment where sharing of intelligence, construction of meaning, and social propagation of ideas and skills is a norm, continuously probing for those cognitive and emotional elements that might constitute an effective, innovative, and mutually satisfactory solution. Games [...] greatly enhance and facilitate communication among the key stakeholders, resulting in shared understanding of the need and direction of change, as well as in the increased propagation of best practices (Wenzler and Chartier 1999, p. 381).

In light of the many advantages in utilizing research-based serious games, the JRC study team recruited foresight gaming system experts in order to co-design a serious game. HRCFS and CPPFS collaborated with members of the EU JRC team

to develop game mechanics, design parameters, and prototype iterations. Employing an iterative prototype design methodology to accomplish all of the above, a variety of system configurations were explored in pursuit of a serious game that best met the requirements and objectives (Schrage, 2000, p.137). The primary challenge was: to help people, primarily those who did not participate in the foresight study, come to understand the study's outputs and, perhaps most importantly, explore and deepen the scenarios. The latter was of utmost importance to achieve the ultimate goal of helping build common visions of a sustainable future.

Further reflection led to the realization that the scenarios could also be used to develop strategic reflections on specific issues in the future. Therefore, the challenge was actually two-fold: how to engage stakeholders in the results of the foresight study so that they could reflect on a shared and desired vision for a sustainable future, and how to best use the scenarios to help people imagine new possibilities, threats, and opportunities created for specific issues in the transition towards a sustainable EU economy. This could be invaluable in giving a systemic understanding of the consequences a given policy choice can and might have under a particular future scenario.

The objectives of the development of a serious game were: use the scenarios to help players think systemically; make players discover and create alternative realistic futures; and to build a novel stakeholder engagement platform applicable to a broad range of topics. The specific advantages of developing a serious gaming platform was to make abstract discussions about potentially radical decisions and consequences for stakeholders more concrete while providing an arena for prototyping/experimenting new policy approaches that would cut across thematic and policy silos. The process of experimentation and testing of new methodologies took place in the frame of the development of the new JRC EU Policy Innovation Lab competences.

Gameplay

4.1 Overview

The game experience was engineered to give diverse stakeholders a role-playing opportunity to engender individual and collaborative foresight from unfamiliar and contrasting perspectives. Complementing this role-playing game dynamic, each game participant is responsible for co-creating a shared narrative during gameplay, and we utilized these world-building dynamics “to create powerful learning environments for analysis and predication modeling, evaluations, and education” (Jackson, 2004, p. 24). This particular dynamic fosters situational learning and generated negotiations between players while simultaneously allowing for scenario exploration and future-oriented strategy and policy development. More specifically, the game consists in making four actors from three stakeholder groups (businesses, policy makers and civil society organisations) try to achieve their respective long-term objectives under the watch of the public in the context of two contrasting scenarios. Two models of gameplay were designed, and we have included an overview of rule set A, as well as some pages from the facilitator's guide, below.

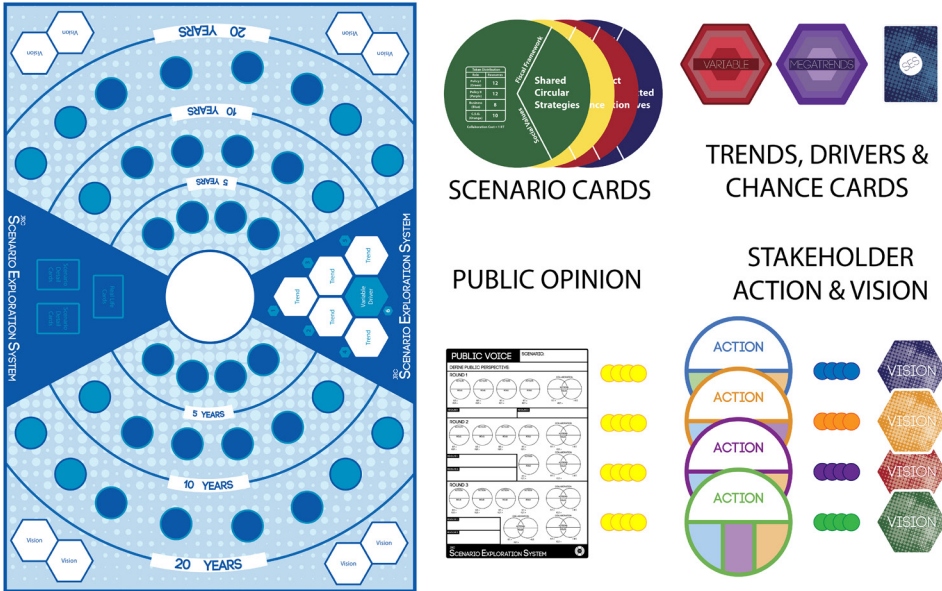


Figure 2. The main physical elements of the JRC SES

4.2 Introducing players to the game

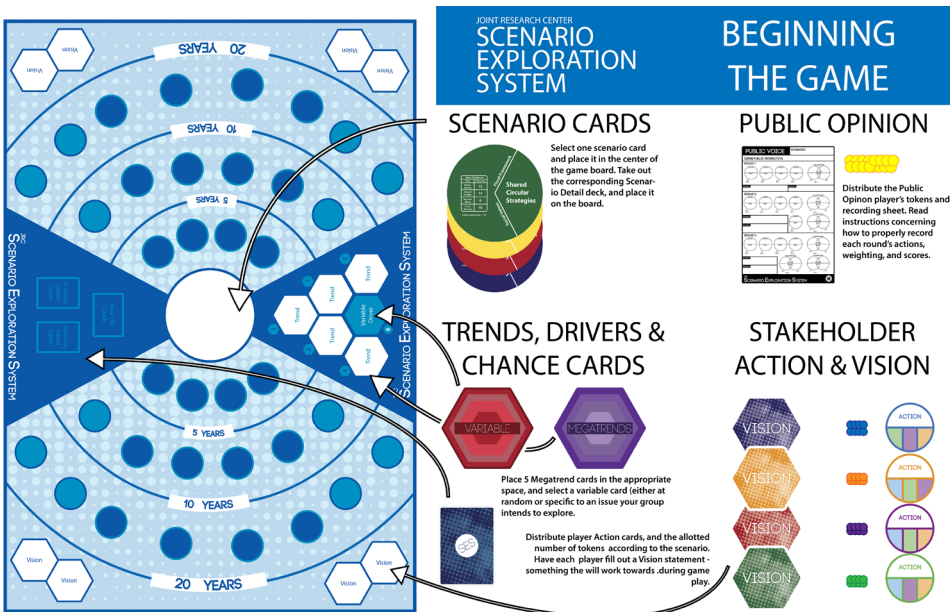


Figure 3. Setting up the game board

Each gaming session requires a Game Master—a facilitator to present the key framing elements at the basis of the stories to be developed, preserve the scenario logic and assist players when needed. The Game Master engages with the players to select a set of scenarios to explore based on the interests of the group. He provides

the group with a brief summary of the nuances and characteristics of the four scenarios. On that basis, a set of two scenarios is selected, preferably diagonally opposed on the 2X2 matrix to maximize contrast. Indeed, a full game makes the players explore two contrasting scenarios while keeping the same roles and pursuing the same objectives. This reinforces systemic understanding and strengthens the realization of the importance of the framing conditions.

The first scenario card is placed at the center of the game board in the appropriate space. This card indicates the resource allocation for each role in this scenario. Next, five of the core drivers (Climate Change Impacts; Consuming Class Booms; Urbanization; Influence of Millennials; Hyper-connected World) in each scenario are already defined by the scenario itself, and the Game Master places those drivers within the spaces on the board numbered 1-5. The sixth “variable” driver is selected by the group through either a) discussion or b) random selection, and is placed in the appropriate space on the board.

Rule set A uses five player roles: Policy I (EC-level), Policy II (state-level), Business Actor, Civil Society Organization Actor, and the Public Voice. Participants were asked to contribute to the narrative element of each scenario by articulating the specifics of their role (identity, nature of role, objectives, and other role details), creating and explaining their decisions during each round (role-specific justifications), and crafting defences for the long-term efficacy of their strategies (balancing short-term capacities with long-term vision achievement). Having each player create a vision, or goal, of what they want to accomplish within a given time horizon, strengthens this facet of gameplay. As the JRC SES aims to enliven novel insights about long-term policy opportunities and challenges, players using both policy roles were required to keep their visions for the future open, or public. On the other hand, business and civil society organisations could choose to keep their visions secret until the end of the first round, but all long-term goals should be couched within the general context of sustainable development.

4.3 Start of the game

After each player has placed a vision card, gameplay begins five years into the future with a short introduction to the world currently in play. The two subsequent horizon-based rounds (10 years, 20 years) lead players to explore and deepen the understanding of what the path towards the scenarios entails. Players make moves by developing action cards, which they generate based on the specifics of their role and the set of events relevant to the current round. They also make reference to one particular scenario characteristic that has been introduced in the round. As each round of gameplay unveils a more coherent yet complex world, participant responses must be continuously role-driven, but players are also required to consider and reference predominant trends and emerging issues, which are introduced randomly with the flip of a new card for each round.

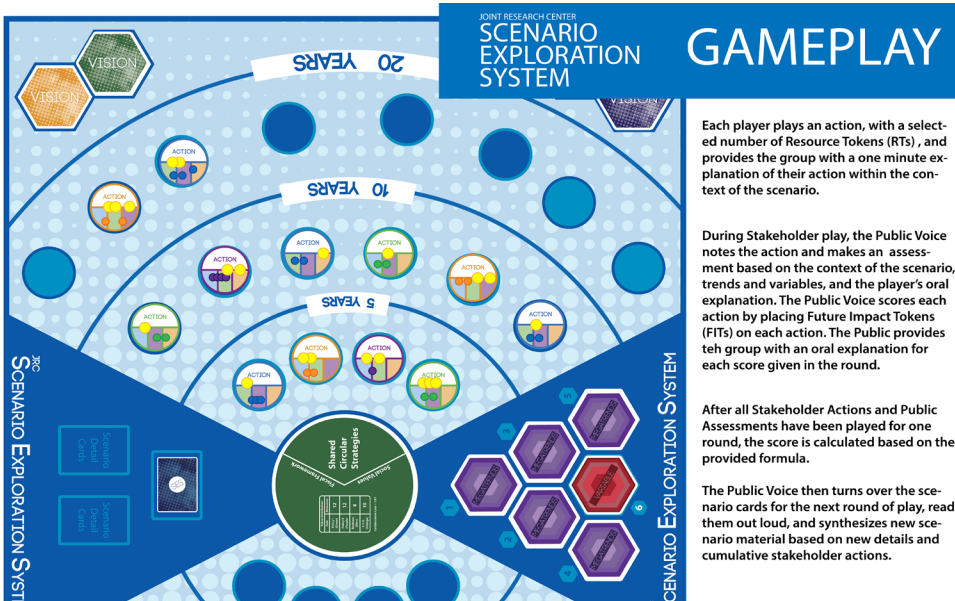


Figure 4. Illustration of actions taken in Round 1

In the first round (near-term future), players can only make individual actions but they can collaborate with other players in later rounds. Collaborative actions require agreement from all involved parties and shared resource investment, which may not be possible for all players given the imbalanced resource distribution of each scenario. At the end of the three rounds, players start again and play the same three rounds in another scenario.

4.4 Scoring

To encourage competition and complement the subjective and creative skills the game demands of each participant, a scoring system was developed, — a key dimension of any successful game design. The game’s economy functions as a result of two measures, both of which use tokens to allow for non-verbal contributions:

- A limited pool of resources, known in the game as *Resource Tokens*, are attributed to each role weighted according to a role’s position of influence, capacity, and/or power within each scenario.
- A multiplier system, known in the game as *Future Impact Tokens*, are the primary resource of the Public Voice player, whose main task is to judge all other player actions. In placing tokens on each action card played, which doubles as a form of scoring and weighting, the Public Voice player exercises a significant amount of power in judging how successful actions are, although the degree to which they are integral to the narrative is dependent upon how much players invoke public sentiment when action cards are played.

The score for each action is obtained by multiplying the total number of Resource Tokens attributed by the players by the number of Future Impact Tokens

given by the Public Voice. Total points obtained by each player for each round of play are the sum of all the scores of the actions in which each player is taking part.

4.5 End of the game



Picture 1. Early stages of game design

In order to stretch the imagination of players and to emphasize the strong influence of contextual factors on their capacity to act and impact, one complete game leads the players through multiple rounds (5, 10, and 20 years) in two radically different but equally plausible scenarios while keeping the same identity and objectives. As such, a player experiences two very different worlds from the same perspective, and in experiencing a shift in resource capacity, which translates into one's ability to act and overall impact, players experience first-hand the varying dynamics of each world.

At the end of each phase of the game, under each of the scenarios, scores are tallied and players assess how close they are to their respective objectives. This provides two ways to assess winners. Once both scenarios have been played, this can serve as a basis for a debriefing discussion. A few typical questions come up:

- Was the player with the highest score who was expected?
- How do you explain the differences under the two scenarios?
- Irrespective of the scores, have players managed to reach their objectives?
- Can we talk of collective success in reaching a more sustainable future?
- What was unexpected? Does that make sense?

Depending on the reason for playing the game or the theme selected for the game, a more in-depth discussion can be built on the outcome of the game to reflect on what it means for the them or organisations of interest.

A recording system was developed to harvest the unique, participant-generated narratives during the gaming sessions as a basis for de-briefing, further discussions, and strategic analyses after the game. Each participant was required to record

the circumstances that surrounded each decision that they made as well as their reasoning for each move. This type of information gathering results in a highly qualitative data set, reflective of the complexity of each scenario, and the diversity of perspectives surrounding any given issue. Once the players complete a quadrant, or scenario, they reveal their visions. This sets the stage for the game master, who facilitates play, to help players reflect on their experience and the outputs from the first round. Aside from ensuring that all rules are followed and that the game does not extend beyond an unreasonable time, the game master is ultimately there to create a smooth transition from one round (or quadrant) to the next and, perhaps most importantly, to ensure that the players have a positive and impactful learning experience. Several win-conditions were designed into the game, mostly to create gaming dynamics rather than emphasizing that winning is the main outcome of playing, and the game can have several winners: the player that has the highest score (wielded most influence) throughout the three rounds; players that have reached their own vision; players win collectively by how close their game has brought them to a seemingly sustainable future.

Game Development

The JRC SES was developed over a four-month period and entailed running 10 gaming sessions. The players were selected from various services of the European Commission and from other organisations (industry, civil society, academia, etc.). Using this model we conducted separate two-day testing sessions in January 2015 and February 2015 with a total of four testing groups with each group split into Game A and Game B cohorts. This gave a total of eight survey sets from which to draw and analyze participant data between the different versions of the game. Supplementing these results, also observational data was gathered throughout each game session, noting participant questions, places of confusion in game flow, and moments of learning. The game variations tested during the January session held very distinct differences across our scoring system, the in-game economy, and multiple game mechanic variations. This phase constituted the bulk of the work to address what is known as the “Fuzzy Front End” - the stage of development that is marked by unpredictability, uncertainty, and some amount of chaos (Koen et al. 2007).

When using an iterative process to design a serious game, testing of each version is critical to achieve intended outcomes. After having established the design parameters for the system, the team quickly moved into development mode to generate the first game iteration and to begin testing assumptions. A multivariate form of testing the different game versions was chosen, encoding the different testing variables in two separate rulebooks (Kohavi et.al 2009). The primary goal was to move the game closer to the outputs and successes that were outlined earlier, and to gather data on the progress. Therefore, a participant survey that could provide appropriate responses was crafted. For the in-house purposes this method was called A/B testing, and each version of the game was named accordingly.



Picture 2. Prototype of the JRC SES

After the initial testing session, the various channels by which feedback was collected were reviewed. Upon the review of the survey data and observer notes, immediately the team set upon combining the best results of game versions A and B into a single version that was termed the Beta version. The development of this prototype included new game components that emerged from the A/B test sessions. The “Real Life” Chance Card Deck was developed to balance out the game mechanics in the scoring system, and the new Scenario Detail Cards were developed to facilitate learning outcomes from the Eco-Industries project scenarios. Beta version game rules were finalized in early February, and the game aesthetic was formalized in professional grade card stock and a revised game board.

Beta version prototype tests were conducted between February 23-24th 2014, with a new testing cohort representing future stakeholder groups from across multiple sectors. A revised survey was used to gather participant data at the conclusion of each test session, as was additional observer notes. Again, multivariate testing was used, with slight variations to system mechanics in each game session. These were minor deviations in gameplay, and were not formally recorded in the official game rules document, but were captured in observer notes. Again, the data from the test sessions was combined and analyzed in a final round of design discussion, and resulted in the final alterations to the game system that were submitted as the Final Beta Version.

Lessons Learned, Conclusions, and Recent Developments

After having played more than 20 games (more than 100 participants), it is possible to formulate some general lessons learned from the gameplay and participation in SES game sessions, by drawing upon the feedback received during and after the gaming sessions. Overall, players have found the game to be very fun and enjoyable, while increasing the understanding of alternative possible future scenarios. This is valid for the 5 different roles a player can assume. Players have

also expressed that they appreciated gaining a better understanding of possible long-term consequences of actions played. Many acknowledged that they had faced unexpected developments during the game that broadened their perspectives. The SES has thereby demonstrated its ability to generate pleasant experiences for the players and to raise player awareness of the importance of external framing conditions.

Further, players have expressed that the SES is “efficient to get familiar with role-playing and teaching about scenarios”, and “helps to concretise abstract thinking”, and find that “it is possible to explore policy actions on a given topic in a completely different setting”. Players appreciated the collaboration aspects and enjoyed how the characters and positions of the different players developed during the game, creating unique stories about their own role in a not too distant future during every game. The SES then acts as a foundation for communication between players that would not otherwise interact spontaneously. We believe the JRC SES draws on the “social praxis” of critical social science, and, perhaps most importantly, evokes an epistemology for sustainable development that is, by its very design, a means of “organized self-reflection” (Carr & Kemmis 1986, 149).

Players have also found the game to have a good connection with reality, in that even though the rules are simplifying the complex dynamics at play in reality, the options and ways that a player can act are sufficient abstractions of how developments happen in real life. This is also related to a remark that some players have made: it takes some time to understand the rules and framework conditions and ‘warm-up’. In particular for the game master the introduction before the gameplay starts may seem lengthy. Most players, however, expressed appreciation about the scenario information given, and some would like even more. Overall it looks like the game has found a satisfactory balance between giving sufficient information and keeping some complexity from reality, keeping a sufficiently high pace and introducing game dynamics for fun and creativity.

It was clear that in cases where there was limited time after the game had finished, players often didn’t fully understand the process and the effects of what they had just gone through. However, most participants engaged spontaneously in game-related discussions with fellow players after each gaming session. It is therefore very important that the game master unpack the experience through a facilitated discussion and reflection session. This enables the players to reflect on the actions taken and draw insights, especially from player interactions, that might be difficult for the participants to express. This could potentially be enforced even further by using the results and reflections of a game session focusing on a particular theme/topic, as context, introduction and reminder of the long-term, to a customised workshop where the same theme/topic is to be discussed.



Picture 3. JRC SES in final version with one full scenario played

As a tool, the JRC SES has proven its worth both as a way of providing different audiences with learning experiences relevant to a broad range of issues, and as a way to open opportunities for going beyond today and creating novelty. This serious game is built as a facilitated experience in which the game master has a key role. He/she must be fully present in the game, exploit the creative space left open by the scenarios and act as a catalyst for the players to use their imagination while keeping close guard on the intrinsic logic of each scenario in order to allow the game to reach its full potential.

The JRC SES is now a tool available to the EU Policy Innovation Lab but demand from players has led to a number of interesting developments. First of all, one player has come back with a team from the headquarters of a large Belgian supermarket chain to play the game again. Not only did this experience function well in a team building perspective, but it also allowed them test the platform for further use of the approach in house. The possibilities discussed were high-level strategy development and stakeholder engagement. Demand also came from other European Commission services. DG SANTE commissioned a foresight study on Food Safety to assess if European food safety legislation is “future proof”. In this context demand came to develop a new version of the JRC SES featuring four food safety scenarios and a slightly adapted set of roles. This version of the serious game will be featured as a stakeholder engagement tool at the occasion of a conference organised by DG SANTE at EXPO 2015 in Milan, Italy.

The serious gaming experience generated by the JRC SES also created the know-how and opportunity to participate in a proposal for a research project financed by Horizon 2020, the European Commission’s research funding programme. The purpose of the NANO2TRUST project is to build a multi-stakeholder platform to develop a shared understanding of the current and potential future benefits and risks of advancing nanotechnology. The JRC SES will be used as a framework to apply techno-moral scenarios and road mapping for future-oriented training and dialogue addressing a broad public. The co-design method applied to develop the JRC SES proved very successful and delivered a robust and flexible gaming

platform. Efforts are continuing to look for opportunities to apply this serious game further in European policy-making and beyond.

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