InnoForESt

Smart information, governance and business innovations for sustainable supply and payment mechanisms for forest ecosystem services

GA no. 763899

D3.2 APPLICATION SUMMARY OF PROTOTYPES FOR ECOSYSTEM SERVICE GOVERNANCE MODES - DEMONSTRATOR

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Abbreviations

CINA	Constructive Innovation Assessment
D	Deliverable
ES	Ecosystem services
ESG	Ecosystem service governance
FACC	Factors Cross Work Packages Committee
FES	Forest ecosystem services
IP	Innovation Prototypes
IRs	Innovation Regions
PCA	Principal component analysis
PES	Payments for ecosystem services
RBG	Role board game
SETFIS	Social-ecological-technical-forestry-innovation system
WP	Work package

Executive summary

In the last decades, there has been a growing societal demand for forest ecosystem services (FES) emphasizing flows of goods and services and variety of beneficiaries with diverse values and interests. The beneficiaries can be viewed at global, regional and local levels while providers are mostly local. High complexity of ecosystem service (ES) functioning, high levels of uncertainty, imperfect and asymmetric information between transacting parties tends to result in market and regulation failure and calls for novel – smart governance arrangements including hybrid governance mechanisms essential when the provision of a particular ES is long term and with a common or public good character called ecosystem service governance. Such governance has to bridge sectoral policies into the integrative and shifting the motivation of resource users to sustainability.

InnoForESt project builds on innovation models to identify prototypes or smart governance innovations in the six Innovation Regions (IRs) that represent different forest policy and management practice conditions in Europe and which are interconnected via digital and physical innovation platforms and network approaches.

The key questions to address are: *What kind of governance innovations can support sustainable provision of forest ES in a long term? What are the influencing factors (fostering/hindering) for governance innovations in diverse context particularities? How these can contribute to the reconfiguration and the development of prototypes of FES that target long-term sustainability?*

Innovation Prototypes (IPs) of Ecosystem Services Governance (ESG) are combinations of different policy and business innovations for the management of FES resulted from reconfiguration process in six IRs. IPs emerge among a range of concerned actors in interconnected social-ecological-technical-forestry-innovation systems (SETFIS). Prototypes builds on a scenario narrative affected by various factors that reconfigures innovation niches in SETFIS framework. These are modelled in behavioural experiments to determine holistic basket of economic, socio-cultural, recreational and environmental forest functions and services, and trade-offs between them.

The reconfiguration process entails following steps:

i) Identification of key factors that define governance, policy and business innovation types and conditions for smart governance innovations.
ii) Development of scenario narratives to describe preferred future development.
iii) Testing institutional and business innovations using a model for experimenting for smart and sustainable forest ESG (a role board game – RBG).
iv) Syntheses into the prototypes.

1 Introduction

Challenges of ecosystem service governance

The concept of ecosystem service (ES) for describing the relationship between human societies and the natural environment is historically very recent (Gómez-Baggethun et al., 2010). It puts emphasis on the values of natural systems and socio-ecological dynamics in planning of economic policies by providing incentive for sustainable use and increasing the convergence of sectoral policies. The concept is expected to induce a paradigm shift in the management of natural resources (Cowx and Portocarrero-Aya, 2011) and links natural systems and human well-being (Amsworth et al., 2007; Skroch and Lopez-Hoffman, 2009) to propose effective strategies for a management of vulnerable natural resources and their ES (Kluvánková-Oravská et al., 2013; Kluvánková et al., 2019).

Most ES can be identified as types of goods that are considered either ‘‘common-pool resources’’ or ‘‘public goods’’ (though ownership of the resource base might be private, public, or communal) characterized by two particular features, non-excludability and non-rivalry. If there is no excludability in supply and there is no rivalry in demand, the goods and services are public (most supporting, regulating and cultural ES). If there is no excludability in supply but there is a rivalry in demand, the goods and services are common which is the case of most provisioning ES (Farley and Costanza, 2010; Muradian and Rival, 2012; Muradian and Gómez-Baggethun, 2013; Ostrom, 2010).

European forests provide a variety of forest ecosystem services (FES) (García-Nieto et al., 2013; Plieninger et al., 2013; Saarikoski et al., 2015). In the last decades, there has been a growing societal demand for FES, with varying emphasis on flows of goods and services, beneficiaries’ values and ecological functions (Wolff et al., 2015). The beneficiaries can be viewed at global, regional and local levels (Viszlai, et al., 2016) while providers are mostly local.

When potential beneficiaries are difficult to exclude, free-riding and opportunistic behaviour is likely to emerge, and voluntary coordination mechanisms (such as markets) tend to be less effective (Muradian and Rival, 2012). The common-pool or public nature of most ES implies that market mechanisms or regulations are not always suitable as governance tools, since markets exchange presupposes excludability in supply and rivalry in demand thus tend to be more effective in dealing with private goods. Furthermore, targeting multiple FES rather than single FES (as e.g. biodiversity) reduce contradictions among providers and users, and may positively affect the transformation from sectoral to ES governance (Bastakova et al., forthcoming).

New governance modes

Innovative governance structures (including hybrid governance mechanisms) are essential when the provision of particular ES such as climate regulation is characterized by the high complexity of their functioning, high levels of uncertainty, imperfect and asymmetric information between transacting parties, and cognitive barriers in assessing the service itself. Such as we address it as Ecosystem Service Governance (ESG) (Kluvánková et al., 2019; Muradian and Rival, 2012; Otto, Chobotová, 2013; Williamson, 1991; Primmer and Furman, 2012).

In combination with Payments for Ecosystem Services (PES), ESG can be seen effective for directing sectoral policies to a more integrated approach of the EU regions and with the cost lower than hierarchies or markets (Muradian and Rival, 2012; Kluvánková et al., 2019). We argue that PES can be seen as more effective innovative economic instruments if adding the social dimension by involving local communities and their values to ensure the long-term resilience and adaptation of forest ecosystems to climate change (Sattler and Matzdorf, 2013).

The ESG approach thus offers a novel governance model whereby environmental effectiveness, economic prosperity and community well-being can be sustained via a hybrid governance model that combines the market and self-governance components. Such governance can bridge sectoral policies into the integrative ESG, and shifting the motivation of resource users to sustainability (Constanza, 2008; De Groot et al., 2012; Schroter et al., 2014). ESG views ES as common or public goods, facilitates cooperation between groups, disciplines or sectors with different paradigms or interests, and can also foster interdisciplinary research processes (Jahn et al., 2012). This is challenging options for ESG become central to transfer ES policies to long-term sustainability (Ostrom, 2010; Cook et al., 2016; Barnaud et al., 2018; Chobotová, 2013).

From niche to mainstream with help of prototype development

InnoForESt project builds on innovation models that run from factors for smart governance innovations and scenarios to prototype testing and development. This is realised in the six Innovation Regions (IRs) that represent different forest policy and management practice conditions in Europe and which are interconnected via digital and physical innovation platforms and network approaches. To transform existed forest governance structures towards hybrid systems and enhance sustainable provision of FES requires a fundamental shift and a reconfiguration of innovation options. InnoForESt identify this as a prototype development of ESG modes.

Key to address are questions: *What kind of governance innovations can support sustainable provision of forest ES in a long term? What are the influencing factors (fostering/hindering) for governance innovations in diverse context particularities? How these can contribute to the reconfiguration and the development of prototypes of FES that target at long-term sustainability?*

Figure 1 visualizes the pathways for innovations InnoForESt builds on: (1) novelty creation in and by local practices, so-called innovation platforms; (2) ways for their mainstreaming over time, leading to modifications of the regime (cf. Rip, 2012). More details can be seen in D3.1 (Sorge and Mann, 2018).

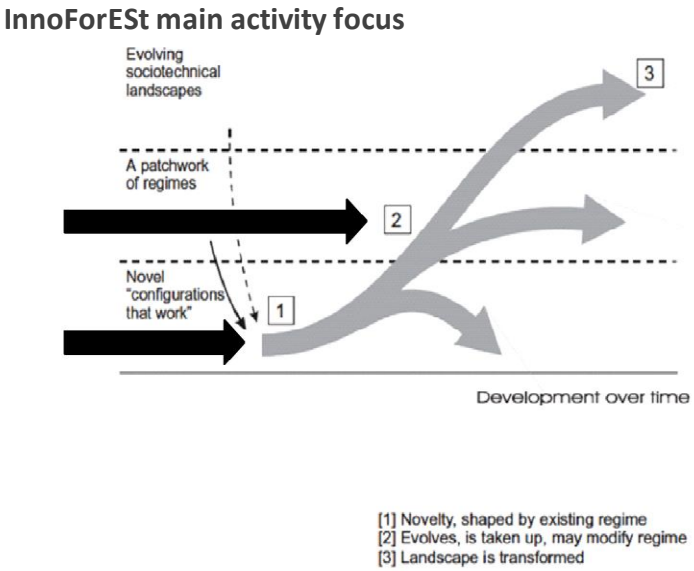


Figure 1 InnoForESt innovation pathways

Source: Mann et al., (forthcoming), modified from Rip (2012)

Further, central to the InnoForESt project is the transdisciplinary approach for the co-identification, co-design, co-assessment and co-implementation of novel policy tools and business models. Scientific partners cover a wide range of natural sciences, political sciences, economics, social sciences and humanities, etc. By integrating interdisciplinary insights, conventional boundaries of practice and analysis in governance and business, theory and research method are crossed. InnoForESt involves sets of stakeholders in the six regional networks from the beginning of the project. In the centre of these networks, stakeholders closely related to niche innovations will partner with influential actors from the forestry regimes at regional, state, national and EU level. Stakeholders include environmental protection agencies, national forestry commissions, a ministry of agriculture, financing and business organisations, private and public forest landowner associations, and protected area authorities associated with six IRs in six countries. These networks can influence the space and context of innovations to work in terms of infrastructures, general policies, actions, and cultures.

This deliverable (D) is structured as follows. The main objective is a reconfiguration of a pool of influencing factors derived in the InnoForESt social-ecological-technical-forestry-innovation systems (SETFIS) framework and scenarios (D3.1 – Sorge and Mann, 2018; D5.2 - Schleyer et al., 2019; D4.2 - forthcoming) which leads to prototype development for sustainable supply of FES. The process of reconfiguration is using a set of means, experiments and methods and including knowledge from stakeholders in IRs, further experts, and insights from the advisory board. The reconfiguration and the prototype development as illustrated in Figure 2 is a back and forth process between Tasks 3.1 – *Analysis framework for the governance of policy and business innovation types and conditions*, 3.2 – *Reconfiguring factors for policy and business innovations*, 3.3 – *Development of prototypes of ecosystem services governance modes*, 4.1 – *Selection and matching of prototypes and real world case studies*, 4.2 – *Co-design and knowledge exchange for the establishment of innovation networks in the selected case studies through a multi-stakeholder approach*, and 5.2 – *Stakeholder integration*.

2 Concept and methodology for prototype development

2.1 Conceptual approach to prototype development

Innovation Prototypes (IPs) of ESG are combinations of different policy and business innovations for the management of FES resulted from the reconfiguration process in six IRs. The reconfiguration results from continuous interactions of dynamics of innovation journeys as to follow Rip (2012) and explained by the SETFIS framework (Sorge and Mann, 2018). Innovations are created within niches, which consist of individual and collective actors, technologies and routines. Actors may have the role of innovation pioneers, enablers or selectors, who push the development and diffusion of the innovation forward, but may also act as blockage. The regime dimension is characterized by existent formal (laws, regulations), informal (norms, traditions) and cognitive (visions, problem/solution definition) patterns, which are formed by the main actors within this system. IPs thus emerge among a range of concerned actors in interconnected SETFIS with upscaling and mainstreaming potentials (see Figure 2). IPs build on a vision that describes a preferred future development of the governance innovation in form of a scenario narrative displayed in the left box of Figure 2. These are effected by various factors e.g. business innovations and governance innovations, such as voluntary payment and trading mechanisms of certification schemes that reconfigures innovation niches in SETFIS framework factors analyses (the upper box of Figure 2). By assessing them in behavioural experiments (the right box) in the IRs settings we are able to model how a holistic basket of economic, socio-cultural, recreational and environmental forest functions and services, and trade-offs between them shall be considered in IPs from both the supply and demand side.

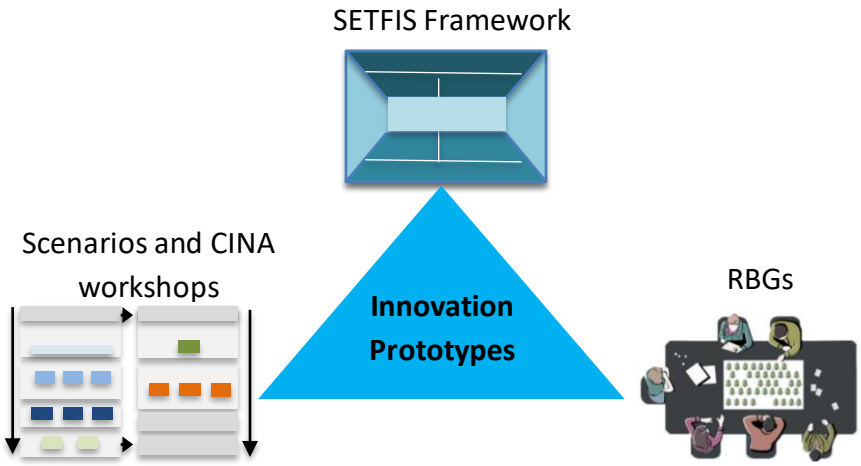


Figure 2: From factors to IPs (reconfiguration)

The reconfiguration process illustrated in Figure 2 is further expanded in subchapters below and concerns the following steps:

- Identification of key factors that define governance, policy and business innovation types and conditions for smart governance innovations. Factors are identified in the previous InnoForESt work (e.g. D2.2 – Varumo et al., 2019) and analysed in the SETFIS framework factors analyses (D3.1 – Sorge and Mann, 2018).
- Development of scenario narratives to describe a preferred future development for each IR at Constructive Innovation Assessment (CINA) workshops (D5.1 – Aukes et al., 2018, D5.2 - Schleyer et al., 2018, D4.2 – forthcoming)
- Testing institutional and business innovations by using a model for experimenting for smart and sustainable forest ESG (a role board game –RBG) applied to six IRs (D3.2. and D4.1 – Sattler, 2019)
- Syntheses into the IPs (Scenarios + RBG+ factor analysis = IPs) (Mann et al., forthcoming)

2.2 Analysis framework for the governance of policy and business innovation types and conditions

2.1.1 Analytical framework

Six governance innovations are forming the focus for innovation actions. These governance innovations and business mechanisms as alternatives to common ones include **markets and payment schemes** for carbon capture and biodiversity preservation as well as actor alliances and networks as public private partnerships that foster improved value chains or bundles of regulating and cultural FES. As a first step for IPs development the InnoForESt analysis framework for interconnected forestry systems (the SETFIS framework) is conceptualised to explore influencing factors on such governance innovations and business models, that builds on the idea of complex SETFIS in the context of the H2020 InnoForESt Innovation Action (Sorge and Mann, 2018). The objective of the framework is to gain a solid retrospective understanding of what has influenced the governance innovations emergence and development retrospectively, and prospectively what needs to be changed for innovation upgrading, upscaling and/or replication.

Integrated concepts include forest management systems, socio-technical systems, innovation systems, environmental governance, governance of change and the socio-ecological systems analysis framework developed by E. Ostrom (2011) as a conceptual basis combined with the multi-actor approach for knowledge co-creation. The interdisciplinary nature of the SETFIS analysis framework supports a comparative analysis over a range of different innovation regions conditions and innovation types while acknowledging the complexity of forestry innovation systems. The systems consist of the following system dimensions that are covered by the SETFIS analysis framework as illustrated in Figure 3:

- Dimension 1 – Actors (Governance System)
- Dimension 2 – Institutions (Governance System)
- Dimension 3 – Biophysical Conditions

- Dimension 4 – Forest Management System
- Dimension 5 – Innovation System
- Dimension 6 – External Influences
- Dimension 7 – Governance Innovation Process

The seven dimensions are subdivided into sets of influencing factors of governance innovations, e.g. power relations and ownership of actors, regulatory or incentive-based policy instruments for institutions, or different forest management strategies for Forest Management System. The term factor refers to observed conditions or processes that influence the innovation and its development process.

The identified dimensions and factors are translated into questions for practical application of the framework in the IRs of InnoForESt. Therefore, the list of questions can be used as a backing tool for elaboration and analysis, which helps to identify the range and degree of factors that have potentially influenced (fostering/hindering) the emergence and development of the governance innovations in focus. The list of questions is structured along the seven system dimensions identified in the literature review, and shall be seen as an additional information mean – together with other insights on actors, institutional and biophysical context conditions from other work packages (WPs) – to gain a comprehensive picture of the innovation situation in the various IRs.

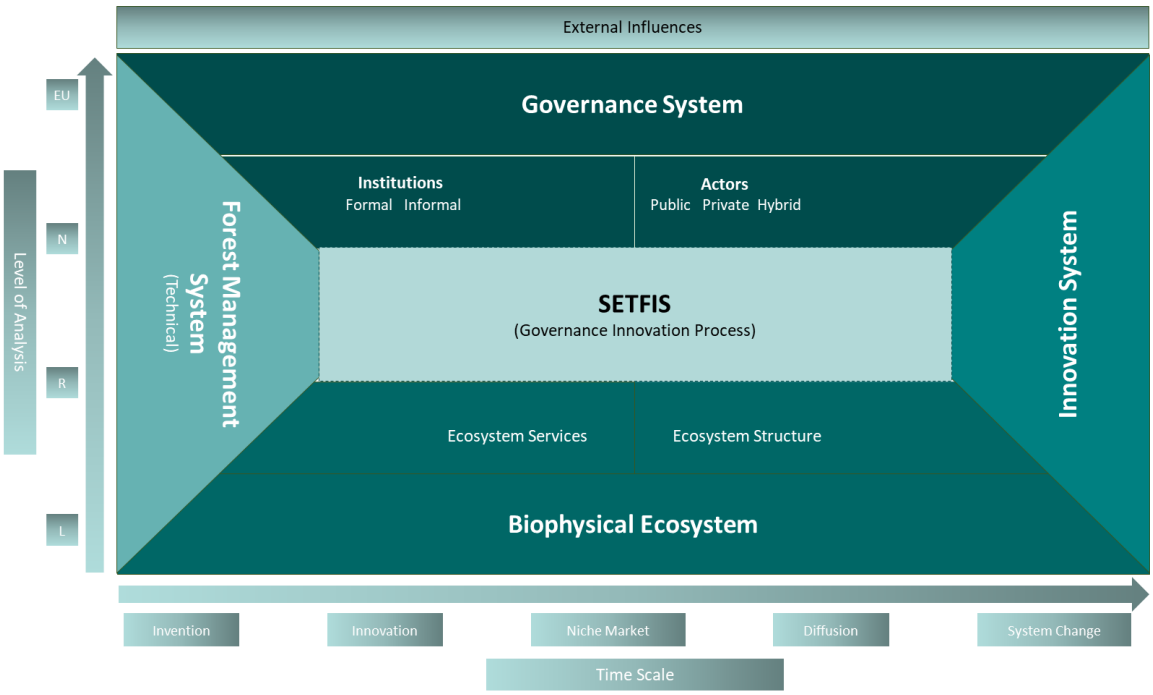


Figure 3: SETFIS analysis framework

Source: Sorge and Mann (2018)

2.2.1 Factors identification and analyses process

The process of factors identification and analyses has been defined for the identification and reconfiguration of key factors to trigger governance and business IPs in 6 InnoForESt IRs as a reaction to the review meeting outcome. It also represents a clear process/mechanism which enables a standardization of future policy recommendations. The transdisciplinary approach has been employed to engage expert and empirical knowledge. Thus, we implement co-production process in order to guarantee the effective exchange of theoretical, expert and empirical knowledge towards IPs development. Co-production is coordinated by Factors Cross WPs Committee (later FACC) involving representatives of the WP3 (Smart ecosystem service governance innovations), WP4 (Innovation platforms for policy and business), WP5 (innovation process integration) and WP6 (Policy and business recommendations and dissemination).

Process concerns the factors identification and analyses. Factors that have an influence (fostering/hindering) on governance innovations are identified in:

- WP2 (biophysical + institutional factors on EU/Member State level),
- WP3 (SETFIS application on regional/IR level and RBGs),
- WP4 (documentation/reflection and CINA activities),
- WP5 (governance and stakeholder analysis).

Theoretical knowledge on influencing factors is derived from the SETFIS framework as described in details in D3.1 (Sorge and Mann, 2018) where SETFIS table for each IR provides an overview of relevant Innovation system dimensions and potentially influencing factors. The SETFIS analysis framework offers a list of questions that helps applying the heuristic to the IRs (see the SETFIS table with questions in the Annex 1). Following the SETFIS approach described above data for all IRs where collected from secondary and primary data sources (steps A and B) and analysed in steps C-F as described bellow:

Step A: SETFIS tables pre-filed for IRs with secondary data from project relevant deliverables (i.e.: D2.1, D5.1; D5.2, D6.2) and other reflection and evaluation documents (i.e.: WP4 CINA workshop feedback notes, WP4 CINA workshop reports, WP4 IR platform feedback sheets) by WP3/T3.1. All influences on governance innovations that are mentioned in the documents were extracted and placed in the respective dimension/factor row for IRs in the SETFIS overview table (Annex 1). Influences that are not clearly related to the original SETFIS dimensions and factors are listed in an extra row at the end of the SETFIS table. The list of factors that have influenced the governance innovations in focus serve as a first indication for further assessment.

Step B: Interviews with key stakeholders have been conducted in each IR by WP3 team members to further elaborate on influencing factors for governance innovations. The interview questions in Annex 1 serve as an interview guideline. With help of the interviews, findings from the document analysis are double checked, and further explained/refined/revised, as well as additional influencing factors identified. Results of the interviews are inserted in the SETFIS overview table.

The overview SETFIS table has been revised in July/August 2019 and includes:

a) a weighting column, i.e. importance of factor; if mentioned,
b) an impact direction column (as fostering/hindering);
c) factor linkages column if mentioned; and
d) the source of information (e.g. D, document, Interview x, y, z).

These categories are applicable for expert analyses conducted in project IRs.

Step C: Factors pre-selection is based on consultation with FACC members and key stakeholders in each IR. As a result, from the consultation 25-35 key factors are pre-selected on a short list of key factors per each IR. Depending on the best available option in each IR in terms of effectivity the placement of consultation process is adapted accordingly. It can be included as a part of a CINA workshop or part of a focus group after a RBG or as a part of an IR task force. Key is to ensure key stakeholders involvement and organise it prior or during regular CINA workshops. The objective is to raise awareness of influencing factors that have been previously identified, and their reflection in scenarios and ensure that workshop debate will touch upon key influencing factors important for further/future innovation activities in IRs.

Step D: Qualitative weighting of factors short list: Factor influences are discussed and collectively consensually weighted during CINA workshops. Ideally, it can be finalized by integrated factors into the scenarios. The debate and outcome of factors pre-selection and weighting needs to be documented by each CINA workshop.

Step E: Qualitative cross case comparison of factors in relation to each other and across the IRs. It may help to find communalities, singularities and correlations among the factors and indicate possible combinations to develop innovation patterns. Will use qualitative data and application of statistical method for comprehensive comparison of factors such as Principal Component Analysis (PCA).

Step F: Linking the identified influencing factors to the financing and provision of forest ecosystem services to understand how the identified (individual or combinations of) factors influencing the governance innovation ultimately impact the provision of forest ecosystem services or their financing. While we may not be able to deliver 'proof' for (all) these links, we should aim to explain their potential impact on FES provision and financing based on prior analyses."

Information on influencing factors will be used as an important information to focus on IR discussions for innovation trajectories and road mapping strategies, and for the derivation of policy and business and management recommendations (WP6 – D6.2).

Step G: Identifying smart innovation patterns: Layering key influencing factors for sustainable provision of forest ecosystem services allows revealing common and different innovation patterns/trajectories that play a crucial role for the governance innovation development.

Finally, a scheme of the whole process of prototype development for ecosystem service governance is illustrated in the Figure 4.

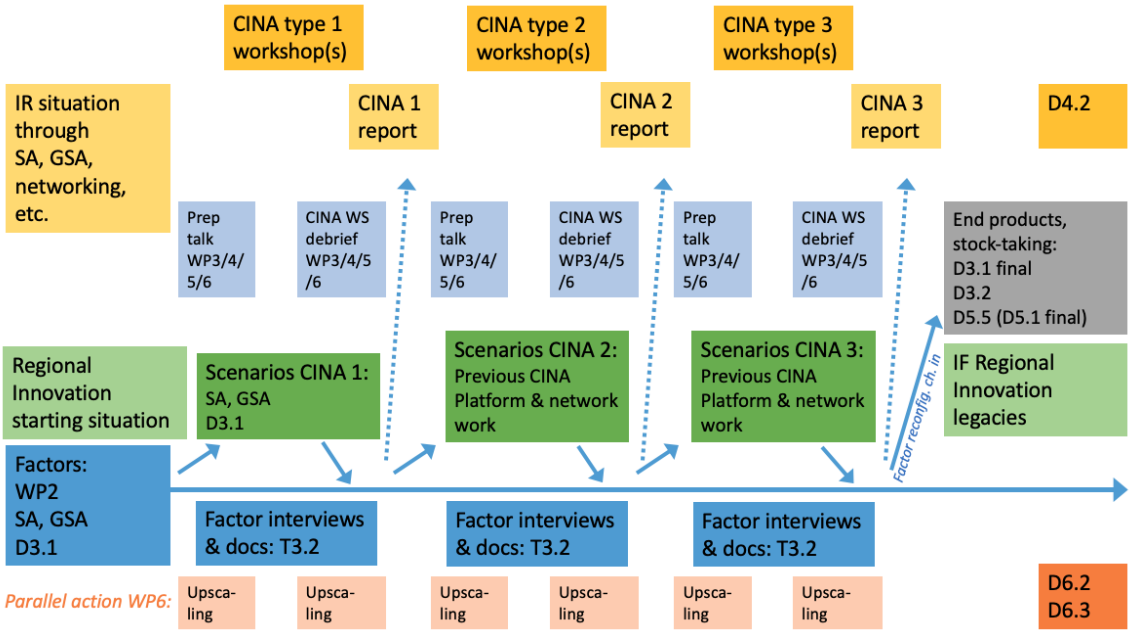


Figure 4: Prototypes for ecosystem service governance

2.3 Development of scenario narratives

The development, testing, and modification of scenario narratives in InnoForESt takes mainly place in the context of three different types of strategic workshops (CINA-Workshops; see D5.1 for details) that have been implemented in each IR over the course of the project: (a) in-novation analysis and visioning, (b) IP assessment, and (c) preparing future conditions. Here, innovation-specific scenario narratives are the main basis for discussion. These can be seen as visions of possible futures of the governance innovation, which become more specific after every workshop and whose focus gradually shifts from innovation definition to scenario development, IP assessment (testing), and, finally road mapping.

The empirical basis for scenario development during the workshop series are various research efforts that have been carried out by InnoForESt during the first year. This includes the mapping of biophysical and institutional conditions for FES across Europe and in the IRs (D2.1), the Stakeholder Analysis (D5.2), and the Governance Situation Assessment (D5.1). Both analyses may also provide hints on activities, (organisational) structures, and ideas existing prior to the InnoForESt-induced innovation platforms and workshops that could foster or inspire the governance innovation development process. Subsequently, through the innovation platforms and the CINA-workshops, the research activities focused more and more on integrating insights and results from the interactions with the stakeholders in the IRs into the further development of scenario narratives and, later, the IPs. Here, the results of one workshop will feed into the next innovation-related activity, and the discussions about the respective (initial or revised) innovation scenario narratives again feed into the next-stage workshop, and the revised scenarios used there (see Figure 5).

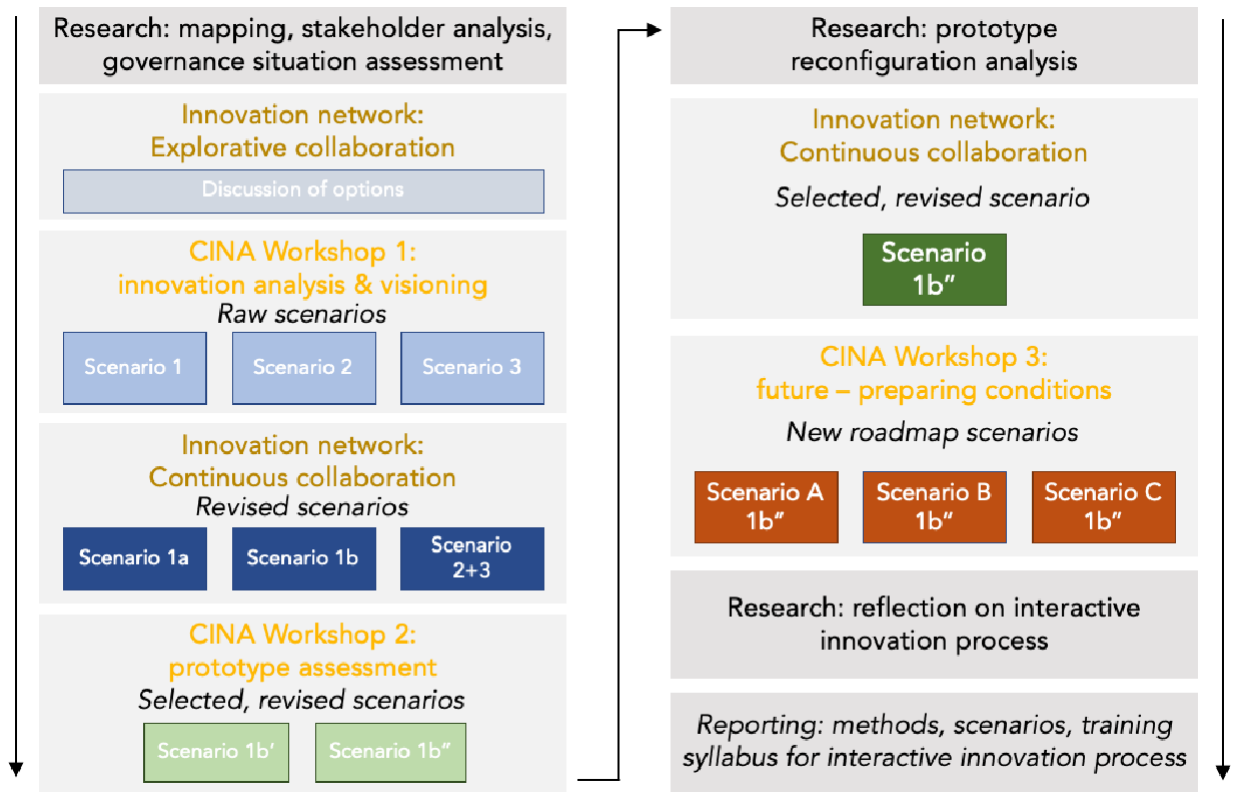


Figure 5: Logic of CINA workshops and development of scenario narratives

Source: InnoForESt D5.1 (Aukes et al., 2019)

The overall aim is here to find the best innovation option, which later can be developed into IPs and tested as such. In the 'Innovation analysis and visioning' phase of the workshop series, insights of the development of the innovation and its key influencing factors are discussed – including aspects related to the 'pre-history' of an innovation. Here, by means of scenario narratives an understanding is gained of what makes a particular innovation (option) work, what the impacts, and what the limits are. It is important that stakeholder interests are closely incorporated in the innovation process, providing as much room and freedom for own ideas as possible. Visioning activities with scenarios are carried out how the innovation might develop in the future (see an example of a matrix for capturing aspects of scenarios in the Annex 2). The outcome is the selection of one scenario as preferred vision, how this innovation shall be further improved and developed (i.e. the IP).

The resulting (identified, discussed, revised) scenario narratives are based on D5.1 (Governance Situation Analysis) and D5.2 (Stakeholder Analysis):

- feed into an estimation of potential effects of activities and into the development of strategies, taking into account desired outcomes and unintended impacts.
- provide the collective reasoning space for identifying crucial issues for the options and pathways, both in terms of potential problems and benefits together with key actors.
- should ideally include those who enact the innovation (because they find it worthwhile) and those who would possibly select it (as soon as they find the innovative results interesting enough, useful, desirable, or would choose for any other reason).

This can mean to involve even third parties not yet directly engaged but promising as potential partners elucidating how certain policy or market conditions, business models, and technological or scientific aspects or conditions of an innovation may become viable.

- show the stakeholders how other actors, who normally might not be involved, could indeed be crucial for the advancement of the innovation.
- can be used as decision aides for selecting participants that actually need to be invited to have the full spectrum of relevant perspectives sitting at the table and being heard.

2.4 Testing institutional and business innovations (Role Board Game)

Following scenario development, **behavioural experiments** are implemented to test those novel governance and management ideas and to determine how different types of factors (compensation mechanisms, partnership, payments, constellations, climate events, etc.) may potentially affect or influence decisions of stakeholders in six IRs. Stakeholder have an opportunity to decide with regard to a more sustainable use of forest goods and services and to get a better understanding of the role and the impact of key innovation factors to transfer IRs to long-term sustainability.

It contributes to the InnoForESt objective 2: Understanding success factors of novel policy and business models. The method allows testing innovation factors and stimulates learning process on the functioning and impacts of governance innovations also across scales (the objective 3), addressing policy recommendation (the objective 4). Both scenarios and experiments are undertaken at and in transdisciplinary workshops as co-production of empirical and theoretical knowledge involving practice partners and stakeholders who are stimulated to interact in projecting possible outcomes of the innovation they are developing in alternatives. Following project objectives key questions are: *How to create conditions to enable innovations for sustainable supply and financing of FES under the diverging interest of FES users? What are effects to well-being in IRs and overall economic, social and ecological effects?*

The experimental approach is built on Cardenas et al. (2013) and Castillo et al. (2011) as an interactive agent-based model arranging for repeated interaction and learning in real-world situations. It contributes to testing the effectiveness of incentives provision for the sustainable production of FES and the acceptance of such an intervention by FES communities (Kluvánková et al., 2019).

The experimental design combines algorithm of a common pool resource game (Cardenas et al., 2013) and a role-playing game (Janssen and Baggio, 2017, Castillo et al., 2011). It has been developed to the climate governance RBG and tested in a lab of experimental social sciences at CETIP between 2017-2018 and adopted for InnoForESt IRs purposes. Standard conditions for all IRs are five groups of FES users/providers that make decisions about the use and management of a forest for FES provision as a governance innovation (see Figure 6). The FES users are confronted with fostering or hindering context conditions (local climate, economy, governance, innovation potential, etc.) and stakeholders' interests.

Stakeholders face changes in conditions/factors (individual/collective action, diversity of rules, innovation factors, external events and disturbances, etc.) and are able to observe/test what conditions lead to a sustainable FES provision in their specific contextual conditions of their IRs. One stakeholder of the game is representing an authority (e.g. national park, regional office, government, bank etc.) external to the forest use but with a regulatory and monitoring power. Specific to each IRs are local conditions of the resource and innovation options and subject roles. This approach creates a space to test innovation activities for the IP development (reflecting scenarios as preferred development options for the IRs). RBGs allow testing stakeholders' specific behaviour for resource use, and innovation activities, to create economic incentive, knowledge and social value. We argue that this helps to set conditions for successful development of policy and business innovations in InnoForESt innovations regions and to foster collaboration on the FES provision for the sustainability among stakeholders in a long term. Comparable behaviour patterns prior and after innovation are observed under the controlled conditions to identify what kind of motivation makes innovations become attractive for actors to get involved in payment schemes. The approach enables to test comparison of different types of innovation factors and their effects on efficient delivery of ES. Several best performing designs of IPs may be then proofed in practice.

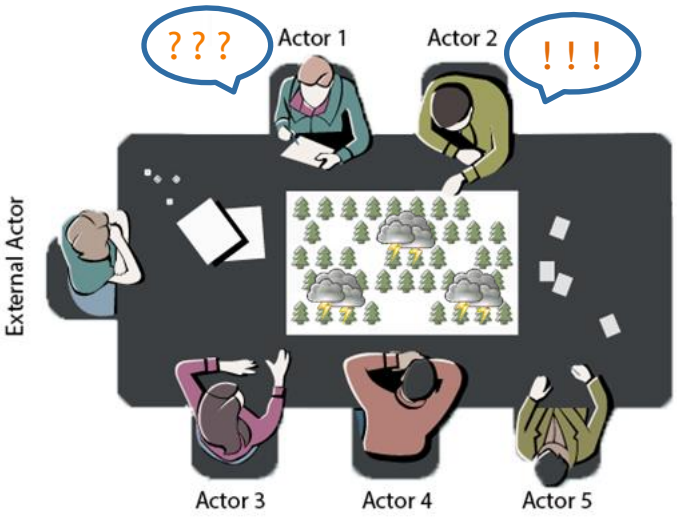


Figure 6: Actors' interactions during InnoForESt RBG

The game consists of two optional treatments. Each treatment has two stages (two parts with 10 rounds to play with changing conditions). The stage one is a baseline and it is identical for both treatments with certain FES without any innovation in place. In the second stage, treatments are different in factors that may affect decisions and innovations and thus leads to behavioural change of stakeholders. One group plays only one treatment.

Treatment 1 concerns the variety of factors to foster innovations to support FES provision in a long term (state regulations/market PES or a business innovation incentive, etc.). It is here where the preferred vision (from scenarios) for innovation development may be implemented.

Treatment 2 focuses on the governance innovation when the forest is affected by an external disturbance (a climate event, a market pressure etc.). Stakeholders can decide about the introduction of new regulatory rules, such as monitoring and sanctions, and they can collaborate on development of innovative social rules.

After the playing, a short survey clarifies reasoning of subject decisions during the game, their motivations and their reflections on the game design. Furthermore, it follows with focus group discussion to discuss the main findings and game implications for their innovations in the IRs including presenting graphical interpretation of the game performance.

Finally, stakeholders' payoffs are allocated privately that are based on their individual results from the game (in form of financial/material rewards to the stakeholder part is fixed and part is based on their individual decisions during the game).

For more details about the overall RBG logic please see Annex 3.

3 Innovation prototypes development in InnoForESt Innovation Regions

The following text illustrates the methodological approach applied for identification and assessment of key influencing factors for the IP development. Although the process is different in details in each IR based on the particular regional needs and abilities the main logic of the process preserves across all InnoForESt IRs. In this document we demonstrate our approach only on two selected IRs: Waldaktie in Germany and Cmelak in CZ IRs to contrast a new and a well-established innovation process in two comparable socio-ecological systems. Other four IRs (Finland, Sweden, Austria, Italy) are further developed to innovation prototypes under the same methodology.

3.1 From factors to the prototype: The New Virgin Forest (Land Trust Cmelak)

The New Virgin Forest represents an innovative project implemented by the civic association Cmelak (Bumblebee in English) from Liberec, the Czech Republic. Cmelak is a land trust association which implements innovative activities towards more ecologically diversified forests by buying a mono-cultural spruce forest land and gradually transforming it into the multi-species and multi-aged non-intervention forest, so called New Virgin Forest (see Figure 7). The main aim is to increase the biodiversity in the forest. Cmelak started with these innovative activities already in 2003 and currently it owns 35ha of the New Virgin Forest.

Cmelak uses diversified sources of funding for financing their activities, such a sale of the certificates, cooperation with companies and sponsorship, public grants as well as voluntary work of association members. However, the financial sources from the selling certificates (used for buying a new land) is decreasing, as well as money from public grants (used for forest management activities). At the moment the New Virgin Forest's certificates do not attract new buyers as they bought the certificates mostly only one time, although the maintenance of the New Virgin Forest is still costly because young tree requires a protection against overpopulated game. Therefore, Cmelak is looking for some new product/innovation development which will bring continuous sources of funding (Cmelak, 2018).

Figure 7: New Virgin Forest: past (left) and current (right) situation

Source: Cmelak (2020)

The main innovative activities in Cmelak are seen in the way of self-organization of the land trust when thanks to a collective action of key representatives from civic sector the new PES scheme for an increase in the provision of biodiversity as a specific FES was introduced. The Land Trust Cmelak became the direct forest landowner and thus it is able to demonstrate different ways of the forest management other than provisioning FES. The PES scheme is established on the voluntary private payments and public grant funding which enable capturing a new land for increase of the FES as well as the maintenance of the forests.

The prototype development process in the Land Trust Cmelak followed the methodology described in the chapter 2 as well as it based on other direct interactions with stakeholders:

- The first focus group in Cmelak (Liberec, the Czech Republic, 11th July, 2018)
- The second focus group in Cmelak (Liberec, the Czech Republic, 10th January, 2019)
- Interview with a key representative of Cmelak (Liberec, the Czech Republic, 3rd July, 2019)
- Interview with a key representative of Cmelak (Liberec, the Czech republic, 26th September, 2019)

3.1.1 Application of the InnoForESt SETFIS framework in Land Trust Cmelak

Following methodology described in the chapter 2.1 the SETFIS framework (Sorge and Mann, 2018) was operationalized into the interview questions to identify key influencing factors in the IR (step A - see Annex 1). The identification of the main factors was based also on data obtained from the previous analyses, such as stakeholders mapping and governance assessment published in D5.1 (Aukes et al., 2019), D5.2 (Schleyer et al., 2018), D.6.2 (Maier and Grossmann, 2019). These analyses were developed in cooperation with local stakeholders, e.g. see the result from the first focus group about timeline of the innovation development in the Figure 8.

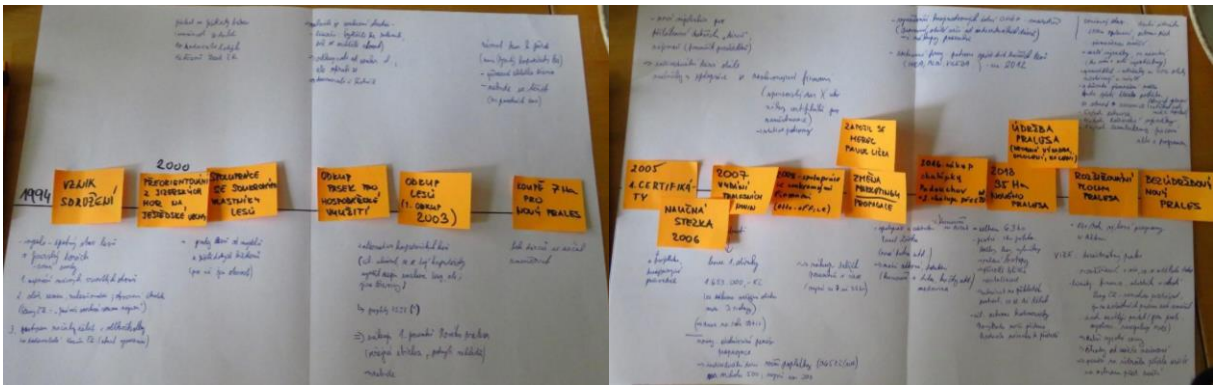


Figure 8: Timeline of innovation in the Land trust Cmelak

Source: Cmelak (2019)

The results from existing documents analyses were combined with the interviews with key stakeholders (the step B) who helped to identify the main influencing factors for innovative activities of Cmelak towards sustainable FES provision. The application of the SETFIS interview was provided by IR team members and altogether 63 factors from the whole list of SETFIS factors (see Annex 1) were identified as relevant with the diversified importance for the innovation activities in Cmelak. Following the CINA workshop discussion and the document analysis a pre-selection of 25 key factors was completed (step C). The preselected factors are broad enough to make space for stakeholders to add the concreate meaning (the way of the influence) for each listed factor during the group discussions at the CINA workshops. These pre-selected factors are illustrated in the Table 1 below.

Table 1: The list of the key pre-selected influencing factors for innovations in the Land Trust Cmelak IR identified from SETFIS framework

The pre-selected influencing factors
Financial compensations /Payments for non-productive ecosystem services
Predictability of the institutional environment
Enough information for decision making / capacity to continuously evaluate the information
Emphasis on the provision of non-production functions of forest / ecosystem services
Economic profitability (of different types of forest management)
Environmental awareness
Traditions, culture, habits (informal rules)
Possibility of flexible forest management
Environmental policy instruments (subsidies, incentives, support for research and development, etc.)
Informal relationships – (dis)trust between actors
New business opportunities
New technologies / new knowledge
Support from public (civic society)

Political support / political will
Legal environment (existing legislation)
Natural disasters (bark beetle, windstorms, floods, etc.)
Diversity of interests of actors (stakeholders) in the territory
Sharing information and experience among key actors
Strength and representativeness of stakeholders in the decision-making process
Cooperation of actors / entities in the territory
Nature protection (protected areas, national parks)
Forest ownership (state, private, municipal, church, land association, etc.)
External threats (social, economic, political, etc.)
Leadership / visionary (bearer of new ideas)
Change in natural conditions (climate change, air quality, water regime, etc.)

The selection was based on the answers to the interview questions where respondents estimated a relative importance of each factor. The pre-selected 25 factors were consequently subject to collective weighting (D) during the CINA workshop in Liberec as a part of the RBG discussion, which took place in Liberec, 1st October, 2019.

3.1.2 Application of the CINA workshops to form scenarios in Land Trust Cmelak

Factors identified in (interviews and focus groups) reflected formulation of the Cmelak's the three scenarios.

Scenario 1: State regulatory (compensations)

The first scenario develops the idea of the state support to all forest landowners – it sets up and compensation scheme to meet Czech/European nature conservation or climate regulation goals. The first scenario depends primarily on the amendment of legislation and the introduction of compensatory fees for sustainable forest management supporting the provision of non-productive FES. The compensation fees could be paid by local or national government or other institutions of public administration, possible even by EU Funds (e.g. Common Agricultural Policy). A prerequisite is the valuation of the cost of environmentally friendly methods, practices and forest management techniques, as well as the values of non-production FES that will be supported through the application of these practices. This option would support the conservation of nature, FES provision and the promotion of biodiversity in forest ecosystems, and by economic incentives would motivate forest owners to conserve their management in a way that does not reduce their profits. Research institutions would also play an important role here, aiming to reward ES benefits and lost profits and set up a compensation mechanism. To implement this scenario in practice, amendment of legislation in combination with political willingness are needed.

Scenario 2: Local markets (PES, wood certificates)

The second scenario is based on value added of the local wood on local/regional market. It is expected a creation of a local certification provided by a trusted certification authority which will connect local wood producers with local/regional customers' restaurants/hotels/public administration. The certificated will be issued only in relation to the certain sustainable management of the forest reflecting the non-production FES. Greater involvement of regional firms and actors in the forestry - wood product value chain. It uses the support of the local economy and the willingness to pay for regional but more environmentally sustainable products. There is a growing demand for local products worldwide. This is especially true for food, but this principle could be applied to wood products. This wood from sustainably managed forests can be more expensive than conventional wood, but forests can provide more non-production FES in a given area and reduce the negative impact of a transport. This scenario was inspired by the practice of the Austrian Eisenwurzen, where typical buyers include local governments, designers or companies. In this scenario, the demand for sustainably produced regional timber and the provision of a certifying / umbrella body are essential.

Scenario 3: Hybrid ES governance (FES, community payments)

The third scenario develops the PES designed and managed by the community itself. It is expected to have the payment scheme based on a selling of carbon „indulgences"to reduce a carbon footprint in a way of certificates of CO2 reduction for tourist, local businesses and wide public. The concept is based on the idea of FES as marketable goods in a way of continuous financial resources for wood chipping, planting new trees/forests, other carbon forestry technologies. Voluntary PES instruments can be used as a long-term (recurring) source of finance for innovative forestry approaches. Users of ecosystem services (residents, businesses, tourists, etc.) will pay voluntarily (e.g. by purchasing certificates) for the provision of ES. One option is certificates for the provision of forest ecosystem services linked to the carbon cycle. CO2 emissions are a socially resonating issue. An alternative tradable function may be to promote biodiversity, which Čmelák now sells in the form of its New Forest patronage certificates. However, payments would again be made on an annual basis in the form of "indulgences". In general, this scenario means an extension of current practices of Cmelak. They are already selling certificates (focused on biodiversity only), but they are usually purchased only once by each customer. The goal of this scenario is to find from a financial point of view a sustainable source of money to extent the innovative forestry practices of Cmelak

Each scenario represents a configuration of influencing factors for the IR. Stakeholders agreed that the combination of scenarios is needed for Cmelak. The most preferred future development of innovative activities is seen in the combination of the scenario 1 and 3, it means combination of the state compensation scheme with self-organized voluntary payments for the provision of additional FES. The scenarios as well as key influencing factors were discussed with Cmelak's stakeholders at the CINA workshop in Liberec, 1st October, 2019 (see Figure 9).

Figure 9: Discussion of scenarios at CINA workshop in Liberec

Source: Cmelak (2019)

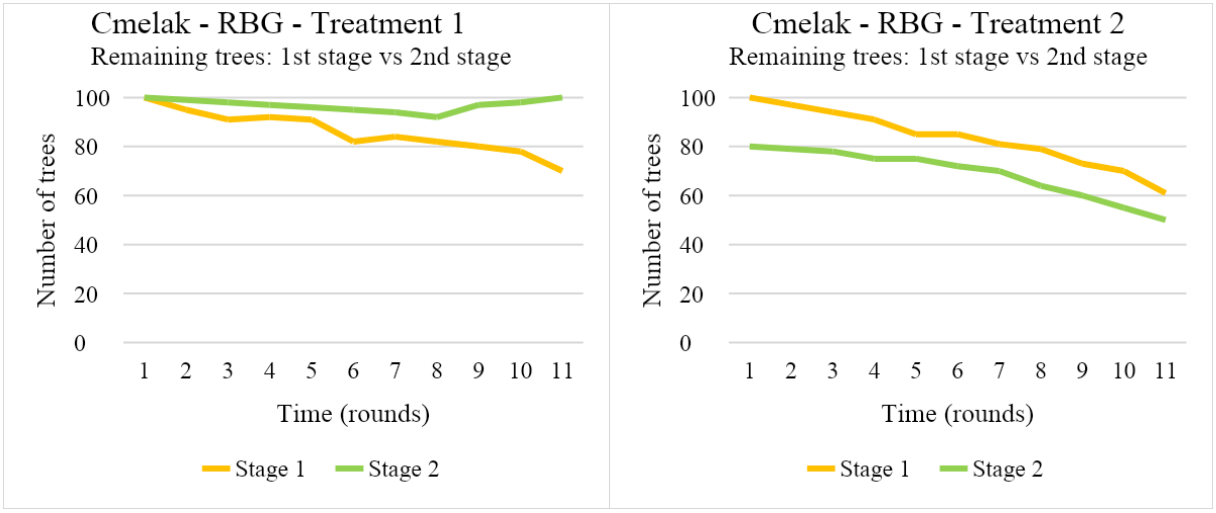
3.1.3 Application of the RBG in Land Trust Cmelak

The RBG was conducted with 12 stakeholders as a part of the CINA workshop in Liberec (see Figure 10). In cooperation with IRs representatives the concept of the RBG was adapted based on the designed scenarios as well as key identified factors. The key adaptation related to the introduction of biodiversity provision of the forest in to the game mechanism as well as bark beetle plague calamity with related regulations. Another adaptation related to the integration of the three scenarios in the innovative incentives.

Figure 10: RBGs in the Land trust Cmelak

Source: Cmelak (2019)

Treatment 1 (T1) offered innovation options determined in 3 scenarios. Players selected an option that concerns hybrid PES (combined with local institution) which are dependent of individual behaviour of actors. Treatment 2 concerns regular forest and post-calamity management (existed practice) with regulation of maximum harvesting and inspection (second stage). First stage was baseline in both treatments. In both treatments factor of wind calamity was integrated with gradual probability depending on quantity of forest stock left in the game.



The axis y shows number of remaining trees in the forest, the axis x shows rounds of the RBG, the number of remaining trees in each round depends on the players' decisions; Treatment 1(the left side): Innovative PES - Remaining trees stage 1 and 2 comparison, Treatment 2 (the right side): Regular forest management - Remaining trees stage 1 and 2 comparison

Figure 11: Results from the RBG in the Czech IR

Innovative PES based on hybrid ESG principles positively triggered behaviour of players to maintain forest stock almost at maximum as evident from Figure 11 – Treatment 1: stage 2 compared to standard forest management practices (Figure 11, Treatment 2: stage 2). Behaviour of players tested prior innovation (stage 1) has demonstrated similar performance in both groups.

As a part of the RBG was also a follow up discussion devoted to identification and weighting of key influencing factors for innovation development in the Land trust Cmelak (Step D) as described in section 3.1.4 bellow.

3.1.4 Final identification and weighting of key influencing factors for Land Trust Cmelak

Pre-selected factors from Table 1 were print out in the coloured papers (each colour of papers represented an internal division of factors into groups: Stakeholders and relations, Institutional environment, Environment, Forest management and ES) (see Figure 12). The pre-selected factors were put on the table and stakeholders were asked to discuss why these factors are important and how they influence the innovation process. These preselected factors were used as support for the discussion as they represented broader terms to which a concreate meaning was given by collective discussion among stakeholders. At the same time, stakeholders were encouraged to developed their own factors or reframe the printed factors to fit better to their experience and knowledge.

Figure 12: Pre-selected SETFIS factors for the group discussion

Source: Cmelak (2019)

After a short time for reading all the factors participants were asked to highlight the most important factors according to their view. Stakeholders were asked to collectively identify 10-15 key factors which have influenced governance innovations in the IR. Participants themselves introduced a voting process for each factor from the list to preselect the most influencing factors (see Figure 13). Based on this process they quickly sorted the factors according to their relative importance for the IR, added new factors or modified pre-selected ones and based on the discussion for each factor the final list of the key influencing factors for the development of Cmelak's innovative activities was produced.

Figure 13: Process of final selection of key influencing factors for the Czech IR

Source: Cmelak (2019)

After the group selection of the key factors individual assessment of the importance of factors followed. Each of the participants has the opportunity to vote for three factors, which have the most positive influence, and for three factors, which has the most negative influence on development of innovative activities in Cmelak IR towards the sustainable FES provision. Each participant got three green self-adhesive dots (positive influence) and three red dots (negative influence). They could choose from the set of factors and could agree or disagree with the group decisions (see Figure 13).

Figure 14: Assessment of key influencing factors identified by stakeholders

Source: Cmelak (2019)

Based on the number of dots it is possible to create the final list of key positive and negative influencing factors for development of innovations in Cmelak with their weighted importance (see Table 2). The right two columns of the table show number of positive/negative votes for each factor provided by stakeholders. From the final list it is evident that stakeholders consider ongoing natural disturbances (bark beetle plague calamity) and climate events in the Czech Republic as an opportunity for development of their innovative activities because they increase public awareness and support. It also creates a space for policy emphasis on provision of non-production forest functions. On the other hand current political support and unwillingness to support changes in the forestry sector together with current established customs, traditions and informal rules and emphasis on short-term profitability hinder the development of innovations in the Cmelak's IR. Stakeholders also agreed that one of the main challenges towards achievement higher biodiversity in Czech forest is also over populated game (wildlife) because it increases the cost of planting deciduous trees due to implementation of a necessary protection against wildlife. This is also linked to the lack of legislation in this area (the Hunting Act).

Table 2: Key influencing factors –weighted: Liberec, the Czech Republic

Influencing Innovation factors	No. of positive votes	No. of negative votes
Natural disturbances (bark beetle, storms,...)	7	0
Climate events (Climate change, water management,...)	4	0
Public support	4	0
Political support/political will	3	7
Sharing information and knowledge among key stakeholders	0	2
Cooperation of actors/subjects in region	2	0
Policy emphasis on provision of non-production forest functions/ ES	5	3
Economic profitability / performance (different types of forest management)	1	7
Ownership of forests (state, private, church, land trust,...)	1	3
Financial compensations/PES	3	1
Overpopulated game	NA*	NA*
Culture, habits, customs and informal rules	0	6
Legislative	1	3

*This factor was added later but with general agreement of the majority of stakeholders as one of the most negative;

Source: Own elaboration based on Cmelak (2019)

3.1.5 Innovation prototype development for Land Trust Cmelak

All the previous presented steps lead to the development of IPs of ESG which represent a reconfiguration of key factors for the particular IR. IPs builds on visions that describes the preferred future development of the governance innovation in form of a scenario narratives and integrating key influencing factors identified from SETFIS framework and results from the behavioural experiments in form of RBGs.

As resulted from the discussion of stakeholders during the CINA workshop in Liberec the preferred future development of the governance innovation of New Virgin Forest should be based on the combination of state regulatory compensations and voluntary PES. At the moment it seems that there is increasing willingness of politicians for new setting of support and legislation changes in forestry sector in relation to ongoing bark beetle plague in the Czech Republic and changes in natural conditions due to global climate change. Currently in the Czech Republic does not exist any systematic governmental support (financial, technical, consulting) for the forest owners, who would like to focus their activities on non-productive FES. Cmelak together with other regional stakeholders would like to establish a "working group" which will prepare and lobby for changes in legislation towards more sustainable forest practices and supporting the non-production FES. Representatives of Cmelak would like to use this opportunity to assure basic income in form of financial compensations or PES for their innovative forest management in New Virgin Forest with a vision, that this compensation will be available for all "innovative" forest owners. At the same time development of the certificates as an tool for financing the management and expansion of the New Virgin Forest is important and it is expected its scope to cover also FES other than biodiversity. For the success of the innovative activities the support from the general public (based on very good public relations in relation to the non-productive FES) seems to be necessary as well as Cmelak for a long term makes efforts for cooperation among key actors in environmental issues and supports sharing information and knowledge among key stakeholders in the region. For the success of the innovative activities the ownership of the forest directly by Cmelak's community in combination with cooperation with an enlightened forest manager seems to be crucial because it enables a flexible forest management and implementation of innovative approaches. Key specific aspects limiting the faster spreading of similar approaches in more areas is the overpopulated game as it has a high costs of protection of young trees what reduces the profitability. This should be also better regulated by law and Cmelak and other forest owners are prepared to push these changes in legislation.

There is quite limited potential for mainstreaming of this IP for the forest management practices as it seems best working at the small scale in connection with the local communities, however it can easily spread out to the other suitable localities across Europe where are such conditions met.

It seems essential to take into account experience from other InnoForESt IRs in further prototype development, in particular German Waldaktie which is based on the climate forests management and Finnish Habitat Banking which represents a new market-based mechanism for biodiversity conservation to complement the existing policy instrument mix.

This example represents a complex IP of ESG which is developing from the focus on one dominant ES towards the whole spectrum of non-production FES, such as biodiversity, education, carbon sequestration, water management. This diversity of activities also assures a sustainability of the IPs itself.

3.2 From Factors to Prototype - Waldaktie

Waldaktie, another IR within the InnoForESt project is located in Mecklenburg-Vorpommern, north of Germany and can be translated into “forest-share”. Waldaktie is implementing an innovation on CO2 emissions compensation through planting new trees in areas without previous existing forests, climate forests. The compensation is financed by selling certificates that can be bought in the internet or in hotels for example. It is voluntary and the original idea from 2007 was the compensation of emissions polluted by tourists during their holiday in the region in order to better connect tourists and locals to the region and to sensitise the public for climate change and nature protection. Therefore, special events are organised as well, for example planting days for tourists in order to plant the trees themselves. The new climate forests shall be more resistant through mixed species and are monitored by the official foresters, because the land and forests are owned by the state. Besides tourists, private companies are nowadays responsible for around 50% of sold certificates, which are handed over to the clients of the companies.

3.2.1 Application of the SETFIS analysis framework in Waldaktie

The interview with Peter Adolphi from Akademie für Nachhaltige Entwicklung (ANE, Academy for Sustainable Development) was done via a telephone interview on June 11, 2019. Similar to the Cmelak IR, the SETFIS analysis framework was pre-filled with results on important factors from existing documents created during the project until August 2019. After the interview and the comparison with the results from previous documents with the interview, the list of the 82 factors from the original interview guideline was reduced to 60 factors relevant for Waldaktie IR, presented in Table 4, left row.

3.2.2 Application of the CINA workshops in Güstrow, Germany

Two main scenarios have been developed in the IR in Germany during the CINA workshops within the InnoForESt project. Scenario A focuses on multiple effects of integrating CO2 and co-benefits with the main goal of avoiding CO2 emissions and only compensate unavoidable ones. Scenario B on the other side focuses on single effects of CO2 compensation only, with the main goal of unlimited CO2 compensation. Table 3 shows details of the two scenarios developed.

Table 3: Development scenarios for the Waldaktie IR

Scenario	A	B	
Waldaktie 2.0	multiple effect integration	single effect compensation	
Effects integrated	CO_2 & co-benefits	CO_2 only	
Main goal	avoiding of CO_2 emissions, compensation of unavoidable only	unlimited compensation of CO_2 emissions	
Emotional target	individual responsibility	good conscience	
Approach	educational approach → future of earth	voluntary compensation tool → competition to market	
Marketing focus	buy more than necessary → large climate forests	buy as few as necessary → small climate forests	
Potential public refutation	paternalism	"green washing"	
Planting events necessary	yes	No	
Preferred accounting	accounting on basis of calculated ecological benefits and co-benefits	full costs accounting	
To be included	CO_2, biodiversity, hydrologic balance, …	area purchase, climate forest installation and management, management of the Waldaktie, marketing	
Price level	price should exceed full cost accounting	comparable to mandatory measures	
Subsidies allowed	yes (due to educational goals), but not wanted	No	
Transparency	necessary	Possible	
Individuals	prevention of further destruction of earth due to individual responsibility strategic positioning / CSR marketing	compensation of	individual mobility
Tourists			vacation
Businesses			business trips and/or products
Administrations			business trips
Events			emissions related to event
Purchase of land	X	X	
Costs' accounting	X	X	
Benefits' accounting	X		

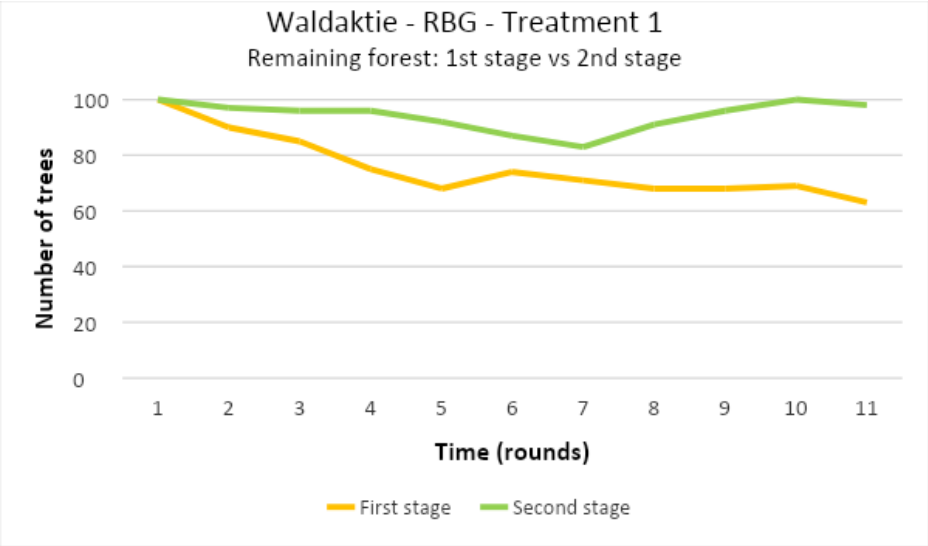
Source: Peter Adolphi, ANE Güstrow, IR Waldaktie

3.2.3 Application of the RBG for Waldaktie

The RBG was conducted with 3 key stakeholders (Treatment 1) in Eberswalde, December 4th, 2019. As a part of the RBG was also a follow up discussion devoted to identification and weighting of key influencing factors. Other three treatments were conducted with master students from University for Sustainable Development Eberswalde as control groups for further comparison of results with stakeholders.

In cooperation with representatives of Waldaktie the concept of the RBG was adapted in form of introduction of climate forest scheme with possibility to buy shares (certificates) for offsetting tourist holiday or support sustainable forest management.

Treatment 1 offered innovation options related to the different PES schemes determined in 3 scenarios. Players selected an option that concerns scenario with the financial scheme for restorations with an investment of initial capital for improved marketing (online payment, integrate sale into other sales platforms, special certificates paper, etc.) to increase revenues in future. In the treatment a factor of wind calamity was integrated with gradual probability depending on quantity of forest stock left in the game.



The axis y shows number of remaining trees in the forest, the axis x shows rounds of the RBG, the number of remaining trees in each round depends on the players' decisions; Treatment 1: Innovative PES - Remaining trees stage 1 and 2 comparison

Figure 15: Results from the RBG in Waldaktie

Source: Own elaboration based on Waldaktie (2019)

Innovative PES scheme based on long-term incentives for a pro-environmental behaviour of the group positively triggered behaviour of players to maintain forest stock almost at maximum as evident from Figure 15 (Treatment 1: stage 2) compared to forest management practice without any incentive. As a part of the RBG was also a follow up discussion devoted to identification and weighting of key influencing factors.

3.2.4 Final identification and weighting of key influencing factors for Waldaktie

The process of identifying key factors is based on the application of SETFIS interview questions which provided identification of 60 relevant factors for Waldaktie. The list of potentially relevant factors was used for the further analysis which was conducted after RBG in Eberswalde, following the logic of the Cmelak IR. The stakeholders were asked to discuss the relevance of each factor and decide about its importance of their positive or negative influence of innovative activities in the IR. Stakeholders used for the weighting the scale from +5 (for factors with the most positive influence) to -5 (for factors with most negative influence). As a result, from the discussion is a pre-selection of 35 most important factors for Waldaktie (see Table 4 for details). The final selection and weighting process of crucial factors will be done in the last CINA workshop in Güstrow in 2020.

Table 4: The list of preselected influencing factors for Waldaktie

The preselected influencing factors	Importance*
Actors' perception (acceptance and legitimacy)	+5
Additional future actors (extension)	+5
Advisory instruments	X
Application scope – e.g. inclusion of new topics	+4
Availability of land	-5
Biodiversity	+2
Central decision making process	X
Certifications	X
Change in natural conditions (climate change, air quality, water regime, etc.)	+5
Control systems (monitoring, sanctioning)	X
Cooperation of actors / entities in the territory	+5
Current biophysical conditions	+3
Diversity among stakeholders	X
Diversity of interests of actors (stakeholders) in the territory	-3
Economic profitability (of different types of forest management)	X
Education	+2
Effects of external markets	X
Emphasis on the provision of non-production functions of forest / ecosystem services	+5
~~En~~ough information for decision making / capacity to continuously evaluate the information	X
Entrepreneurship / entrepreneurship skills	X
Environmental awareness	+5
Environmental policy instruments (subsidies, incentives, support for research and development, etc.)	X
External support	+
External threats (social, economic, political, etc.) = pushing for action	+3
Financial compensations /Payments for non-productive ecosystem services	+5
Forest ownership (state, private, municipal, church, land association, etc.)	+4
Fulfilment of principal main expectations	X
Inclusion of further ES	+4
Identification of beneficiaries/customers/partners	+4
Informal relationships – (dis)trust between actors	+4
Infrastructure (e.g. online tools)	+5
Leadership / visionary (bearer of new ideas)	+5
Learning curves / feedback loops	X
Legal environment (existing legislation)	X
Lobbying / Impact on policy setting	+2
Marketing strategy / Social knowledge	+5
Natural disasters (bark beetle, windstorms, floods, etc.)	X
Nature protection (protected areas, national parks)	X

New business opportunities	X
New technologies / new knowledge	X
Niche developments/ Innovation-friendly environment	X
Opposition to the innovation	-3
Participatory decision making process	X
Policy impact (existing ones)	X
Political support / political will	+5
Possibility of flexible forest management	+4
Predictability of the institutional environment	X
Pro-active behaviour (prevention, not compensation) in future	+-5
Regular meetings	+2
Related (similar/ supporting) innovations	+2
Sharing information and experience among key actors	+2
Short term goals	X
Side effects / Spill-over effects	?
Specific required conditions of ecosystems for functioning innovation	X
Strategy	+4
Strength and representativeness of stakeholders in the decision-making process	+
Support from public (civic society)	X
Traditions, culture, habits (informal rules)	+
Vision (long-term)	+4
Volunteering	+5

**(+5 for the most positive factors, -5 for the most negative factors, X for not relevant factors)*

Source: Own elaboration based on focus group after the RBG in Eberswalde, December 4, 2019

3.2.5 Innovation prototype development for Waldaktie

The IR Waldaktie is still working on analyzing and developing their governance innovation, including several fundamental decisions, containing the main objective of the innovation: compensation vs. reduction of emissions, which leads consequently to further decision pathways, along with pricing and marketing decisions. This development is due to internal dynamics between stakeholders, the IT and external social, economical and political influences. This results into the following conclusion: First, the Waldaktie is behind schedule in relation to the InnoForESt project logic. Being delayed was surprisingly helpful in terms of the sustainable development of the innovation. The reason for this is that an earlier definition of the prototype would have resulted in a pathway that would have created future problems and other related issues. Second, this process shows dynamics and developments that cannot been foreseen, but need to be considered somehow when developing an governance innovation.

Therefore, the IR Waldaktie/Germany has not been developed yet the final prototype, as the IT needs to develop solutions for IR specific challenges. At the moment, developments resulting from the CINA workshops show that there is a possibility for a combined version of the two presented scenarios, from which the prototype will develop.

Furthermore, the IT is opening itself to include opinions and recommendations from other stakeholders related to Waldaktie, e.g. the invitation of their biggest customer to the CINA workshops presents the new openness of the of the innovation in order to further develop it.

Consequently, the last CINA workshop in Güstrow will include two extra parts, first the final factor identification and weighting, as well as the development of the prototype, which then will be used by the leading team of Waldaktie for it further development from Waldaktie 1.0 to 2.0.

4 Conclusion

This deliverable addresses methodological processed for the development of innovation models to identify prototypes of Ecosystem Services Governance to reconfigure them including knowledge from stakeholders in IRs and further experts to prototypes of the sustainable supply of Forest Ecosystem Services.

Innovation Prototypes build on identification of the pool of influencing factors for smart governance innovations and scenario narratives. This results in combinations of different policy and business innovations for the management of FES in the six Innovation Regions that represent different forest policy and management practice conditions in Europe and which are interconnected via digital and physical innovation platforms and network approaches.

Innovations emerge and reconfigure among a range of concerned actors in interconnected SETFIS. These are modelled in behavioural experiments to determine the holistic basket of economic, socio-cultural, recreational and environmental forest functions and services, and trade-offs between them.

The reconfiguration process described in chapter 2 concerned:

i) Identification of key factors for smart governance innovations.
ii) Development of scenario narratives – to describe preferred future development.
iii) Testing institutional and business innovations in a role board game.
iv) Syntheses into the prototypes.

Key fostering/hindering factors where determined via operationalized SETFIS framework (Sorge and Mann, 2018) into the interviews questions to identify key influencing factors in the IRs and applied to all IRs.

Scenario narratives (Schleyer et al., 2019,) takes mainly place in the context of three different types of strategic workshops (innovation analysis and visioning, IP assessment, and preparing future conditions) as part of CINA process (see D5.1 for details).

RBG as the product of behavioural experiments (Kluvankova et al., 2019) tested how different types of factors (compensation mechanisms, partnership, payments, constellation mechanisms, partnership, payments, constellations, climate events etc.) may potentially affect or influence decisions of stakeholders in six IRs. In particular, what factors foster innovations for sustainable FES provision.

Preliminary results (chapter 3) demonstrates comprehensive selection of key influencing factors in consequent Tables 1 and 2. These indicate natural disturbances, public support and policies towards multifunctional FES as key supportive factors in the Czech Innovation Region. While collaboration, awareness, acceptance, legitimacy leadership and new ES beneficiaries were the most important factors in the German IR. It highlights three possible scenarios as a basis for prototype development in respective IRs. Furthermore, pre-selection and weighting of key influencing factors has been conducted at CINA workshops. Preliminary results of RBG indicates that hybrid governance mechanisms based on long-term incentives such as Innovative PES scheme (the German IR) and PES with long-lasting local institutions (the Czech IR) positively triggered behaviour of players to maintain forest stock towards long-term sustainability (Figure 10 and 14).

This indicates potential of network/local institutions and innovation factors as vital prototype for ESG in a long term.

Further work will be required to develop a cross factors comparison, in relation to each other and across the IRs, linking them to the financing and provision of FES and elaborate on identification of innovation patterns as part of the cross WPs collaboration committee (FACC).

It is important to note that, in general, prototype development for smart governance innovation patters are expected to – and indeed do – reflect the overall objective of fostering FES provisioning and financing. However, which FES or combination of FES are actually targeted and to what extent/degree this is 'sustainable' in ecological, social, and economic terms will vary substantially between IRs. Among others, this will strongly depend on the respective stakeholder interests and power constellations as well as on existing policies and legal frameworks that support a sustainable FES provision, or not.

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Annexes

Annex 1: Table with interview questions for InnoForESt Factors analyses

Table 5: Interview questions for InnoForESt SETFIS framework analysis

Dimension 1: Actors (Governance System)					
The focus of this set of questions is to elaborate on actors, specifically to get to know their characteristics and interactions in relation to the innovation in the past, present and future.					
Question	**Answer**	**Factor** (and additional factors mentioned)	**Importance of factor**	**Impact of factor:** Fostering + Hindering -	**Source** (SETFIS INT; CINA; RBG; GI/ES Mapping)
1. **Who is** involved **in the innovation? Please describe the** type of affiliation **of actors, e.g. types: public, private, etc.**		Type of affiliation			D6.2, D5.2 SETFIS INT 1 SETFIS INT 2
2. **What are the different** roles **and** functions **of the involved actors for the innovation?**		Roles/functions/ rights			D6.2, D5.2 SETFIS INT 1 SETFIS INT 2
3. **What** form of collaboration **is used between actors? (*networks, cooperatives, collaboration, loose, close*…)?**		Form of collaboration			D6.2, D5.2 SETFIS INT 1
4. **Has the** actor constellation evolved **and** changed **over time? If so, has this influenced the innovation?**		Evolvement, continuity and change of constellation			SETFIS INT 1
5. **Do** regular meetings **on the innovation exist between actors and regular are they held? Which issues are discussed?**		Regular meetings			WP4.2 (IP), CINA SETFIS INT 1/ SETFIS INT 2

6. **Which actor** benefits **from the innovation? Are they also** dependent **on the innovation?**		Beneficiary/Dependent/relation to ES-GI			D6.2, D5.2 SETFIS INT 1
7. **Who can** change **the innovation (e.g., rights to change the design and functioning, use and application, finances, others)?**		Changer/ categorization of actors			SETFIS INT 1
8. **Which other actors exist in the region (and beyond) who** support **the innovation? Who, why? (not actively involved)**		Supporter/ categorization of actors			D6.2, D5.2 SETFIS INT 1 SETFIS INT 2
9. **Which actor could** enable **certain processes that are important for the future development of the innovation?**		Enabler/ categorization of actors			SETFIS INT 1 SETFIS INT 2
10. **Which actors/groups that are** against **the innovation? Why?**		Hinderer - categorization of actors			SETFIS INT 1 SETFIS INT 2
11. **Are actors** excluded **from using the innovation (purposely/ unintentionally)? Who are these actors?**		Participation (inclusion, exclusion)			SETFIS INT 1, D5.2 SETFIS INT 2
12. **Who has** access to information **about the innovation? (*everyone, certain stakeholder, etc*.)**		Access to/sharing information/ power relations			D6.2, CINA SETFIS INT 1 SETFIS INT 2
13. **Are there any** conflicts **related to the innovation? What kind of conflict?** How to deal **with it?**		Conflict (resolution)/ power relations			SETFIS INT 1
14. **Which** lobbying **activities been realised in order to push the innovation?**		Lobbying/ power relations			SETFIS INT 1 SETFIS INT 2
15. **How is the innovation** perceived **in its environment, e.g. the forestry sector, outside of the current innovation system?**		Actors' perception (acceptance and legitimacy)			SETFIS INT 1 SETFIS INT 2

16. Do you plan to include further actors **in the future? If so, who and why?**		Possible future actors			SETFIS INT 1 SETFIS INT 2
17. Anything else important regarding principal actors that influence the innovation?		Additional			
Dimension 2 – Institutions (Governance System)					
This set of questions elaborates on the influence and effect of rules such as regulations, laws, statutes, but also traditions and habits that influence the innovation in the past, present and future.					
Question	**Answer**	**Factor** (and additional factors mentioned)	**Importance of factor**	**Impact direction of factor:** fostering: + hindering: -	**Source** (SETFIS INT; CINA; RBG; GI/ES Mapping)
18. Have the following policies and strategies an effect on the innovation: Forest Law, Natural Conservation Law, Biodiversity **and/or** Bio-economy Strategy **(state, national, EU, international level)?**		Impact of existing policies			CINA, D5.2 SETFIS INT 1 SETFIS INT 2
19. **Is the innovation** supported by government**? How?**		Government support			D6.2 SETFIS INT 1 SETFIS INT 2
20. Where there any policy changes **in the past that had a crucial influence on the innovation? Which ones and how (positive/negative)?**		(Institutional) Policy-change impact			SETFIS INT 1 SETFIS INT 2
21. Have political changes **affected the innovation like elections, parties etc.? If so, how?**		Political-change impact (e.g. elections)			D6.2 SETFIS INT 1 SETFIS INT 2

22. Which policies are hindering **the functioning of the innovation, and why?**		Hindering/related policies (Hierarchy: hard/soft regulations)			D5.2 SETFIS INT 1 SETFIS INT 2
23. In contrast, what other policies **could** support **the innovation, and how?**		Additional policy support/ related policies			D6.2 SETFIS INT 1 SETFIS INT 2
24. Which specific traditions**,** cultures **or** habits support or hinder **the innovation?**		Traditions, culture, habits (informal rules)			D6.2, WP4.2 (IP), CINA, D5.2 SETFIS INT 1 SETFIS INT 2
25. Are decisions made central or decentral**? How are/could be supportive to the innovation? (networks, PPP – PP – polycentric/hybrids)**		Multiple-centres of semi-autonomous decision-making structures (polycentric approach, networks)			D6.2 SETFIS INT 1 SETFIS INT 2
26. Which particular market conditions support or hinder **the innovation?**		MBI Markets			D6.2 SETFIS INT 1 SETFIS INT 2
27. What could be changed **in the** institutional environment **to help the innovation to develop? (support by government: creative destruction, incentives, subsidies, R&D,)**		Policy instruments + Change/ continuity/resilience			D6.2 SETFIS INT 1 SETFIS INT 2
28. Could the innovation create a new policy setting/law **etc.? If so, which?**		Impact on policy setting			SETFIS INT 1 SETFIS INT 2
29. Which monitoring and sanctioning rules **existent within the innovation environment?**		Monitoring/ sanctioning			SETFIS INT 1 SETFIS INT 2

30. How is public participation **arranged within the innovation environment?**		Public participation			D6.2 SETFIS INT 1 SETFIS INT 2
31. Are there advisory instruments **that support the development of the innovation?**		Advisory instruments			D6.2 SETFIS INT 1
32. Anything else important regarding the institutional context?		Additional			
Dimension 3 – Biophysical Conditions					
This set of questions targets the biophysical/natural environment and explores the influence and relation of those conditions on the innovation in the past, present and future.					
Question	**Answer**	**Factor (and additional factors mentioned)**	**Importance of factor**	**Impact direction of factor: fostering + hindering -**	**Source (SETFIS INT; CINA; RBG; GI/ES Mapping)**
33. What type of Ecosystem Service **(ES) does the innovation provide/foster? (provision, regulating, supporting, cultural)**		ES Type			D6.2, D5.1, D5.2 SETFIS INT 1 SETFIS INT 2
34. Where these ES provided **also** before **the innovation existed as well? To a different degree?**		Provision w/o innovation			D6.2 SETFIS INT 1 SETFIS INT 2
35. How is the local ES structure **defined? (boundaries, size, economic value, dynamics/temporal distribution etc.)**		ES structure			SETFIS INT 1 SETFIS INT 2
36. What particular biophysical/natural conditions **are** important **for the functioning of the innovation?**		Required conditions of ecosystem for functioning innovation			D6.2 SETFIS INT 1

					SETFIS INT 2
37. How do changes in biophysical/natural conditions influence **the innovation?**		Influence of ES on innovation			D6.2 SETFIS INT 1 SETFIS INT 2
38. Which other ES provided **by the biophysical environment that are out of scope of the innovation? (regulating, provisioning, cultural, supporting)**		Other ES			D6.2, D5.2 SETFIS INT 1 SETFIS INT 2
39. Has the ecosystem/ES been improved by the innovation **in relation to its objective set in the beginning? If so, how?**		Improvement (or creation)of ES by innovation			D6.2 SETFIS INT 1 SETFIS INT 2
40. How could the biophysical conditions be improved **for ecosystem service provision?**		Possible improvement of biophysical conditions			D6.2 SETFIS INT 1 SETFIS INT 2
41. Which acute risks **for the ecosystem that can hinder the provision of ecosystem services?**		Acute risks			WP4.2 (IP) SETFIS INT 1 SETFIS INT 2
42. Anything else important regarding the influence of biophysical/natural conditions?		Additional			SETFIS INT 1

Dimension 4 – Forest Management System (FMS)					
This set of questions focus on the management of forests and influence of technical and financial infrastructure for the innovation in the past, present and future.					
Question	**Answer**	**Factor (and additional factors mentioned)**	**Importance of factor**	**Impact direction of factor: Fostering + Hindering -**	**Source (SETFIS INT; CINA; RBG; GI/ES Mapping)**
43. Which particular forest management strategy **necessary for the Innovation (type of FMS – clear cutting – changing)?**		FMS			D6.2 SETFIS INT 1 SETFIS INT 2
44. Does the innovation require any particular infrastructure **such as paths/networks, technologies, digital infrastructure, machinery etc.? If so, why? Change**		Infrastructure/ technologies			WP4.2 (IP) SETFIS INT 1 SETFIS INT 2
45. Does forest or other certification schemes **play a role for the innovation *(e.g. FSC, PEFC)*? If so, how do they influence the innovation?**		Certifications			SETFIS INT 1 SETFIS INT 2
46. What kind of forest ownership **is necessary for the innovation? (PPP, public, private, community based)**		Type of forest ownership			D6.2 SETFIS INT 1 SETFIS INT 2
47. Are specific (forest) entrepreneurship skills **necessary for the innovation? If so, which ones? (accounting, calculating, law, etc.)**		(forest) Entrepreneur-ship			SETFIS INT 1
48. How flexible **needs** forest management system **to be for the innovation to work?**		Management flexibility			D6.2, WP4.2 (IP), CINA SETFIS INT 1 SETFIS INT 2

49. How is the innovation financed**/**financial structure**?**		Financial structure			D6.2,D5.2 SETFIS INT 1 SETFIS INT 2
50. Is there any external financial support **or others types that could provide resources to the innovation?**		External funding			SETFIS INT 1
51. How do the monitoring systems of the ES **work, which are important for the innovation?**		Monitoring of ES/FMS			SETFIS INT 1
52. Which unintended effects on forest management **by the innovation, or the other way?**		Unintended effects			D5.2 SETFIS INT 1
53. How could changes in forest management support the innovation**? Which ones?**		Support via FMS			SETFIS INT 1 SETFIS INT 2
54. Can the required forest management system/strategies be transferred **to other areas (region or countries)? Why or why not?**		Transferability of FMS			D6.2, WP4.2 (IP) SETFIS INT 1 SETFIS INT 2
55. Could it be possible to create any feasible impact on local/regional/national/EU development **in terms because of the innovation?**		Development impact			D6.2 SETFIS INT 1 SETFIS INT 2
56. Anything else important from forest management?		Additional			CINA

Dimension 5 – Innovation System					
This set of questions focus on the type of innovation itself, the underlying reasons for its establishment, its current status, past developments and future needs.					
Question	**Answer**	**Factor (and additional factors mentioned)**	**Importance of factor**	**Impact direction of factor: Fostering + Hindering -**	**Source (SETFIS INT; CINA; RBG; GI/ES Mapping)**
57. What was the initial idea **for the innovation to be established?**		Initial idea			D6.2, D5.2 SETFIS INT 1 SETFIS INT 2
58. What is/was necessary to provide the required space **for the innovation to work (regulations, actors, external processes)?**		Niche developments/ Innovation-friendly environment			SETFIS INT 1 SETFIS INT 2
59. What were the main expectations concerning the outcomes **of the innovation? Fulfilled?**		Fulfilment of principal main expectations			D6.2, D5.2 SETFIS INT 1
60. Has the initial strategy **of the innovation development been** changed **over time? How?**		Initial strategy/ change			D6.2, D5.2 SETFIS INT 1 SETFIS INT 2
61. Has the application scope **of the innovation changed over time? How? (local, regional, etc. – level of analysis)**		Application Scope Sphere of innovation action			D6.2, D5.2 SETFIS INT 1
62. How would you characterise the type of innovation**? (Product innovation, process, service, market, social, policy, business…other?) cut**		Type of Innovation			D6.2, D5.2 SETFIS INT 1

63. How would you characterise the current development stage **of the innovation? (Visioning (promises),** **romoting (planning, developing, investing in R&D),** **mplementation (piloting, allocating responsibilities, resources, to activities),** **pscaling (significantly adding resources and responsibilities, e.g. expanding the area))**		Development stage			D6.2, D5.2 SETFIS INT 1 SETFIS INT 2
64. Are there any control systems**, monitoring and evaluation procedures that** provide feedback **to the stakeholders of the innovation (feedback loops) and indicate emerging problems? If, how do they work?**		Control systems (monitoring, sanctioning) feedback loops			D6.2, WP4.2 (IP) SETFIS INT 1 SETFIS INT 2
65. Do similar innovations exist (in the region)? Are they competing or supplementing each other? **r are they/are there supporting innovation?**		Related (similar/ supporting) innovations			D3.1 app SETFIS INT 1 SETFIS INT 2
66. What would you like to improve in the future **(application scope, functioning, impacts…) of the innovation?**		Prevention, not compensation			SETFIS INT 1
67. What kind of barriers **to the innovation have been recognized?**		Barriers			D6.2 SETFIS INT 1 SETFIS INT 2
68. Is InnoForESt supporting **the innovation so far? How (not)?**		External support			D6.2 SETFIS INT 2
69. Anything else important to know about the innovation itself?		Additional			

Dimension 6 – External influences from larger context beyond case study region					
External factors that have/may have an influence on the innovation is the central part of this set of questions. These factors are about influences of larger scope and impact on the innovation in the past, present and future, we cannot directly influence.					
Question	**Answer**	**Factor** (and additional factors mentioned)	**Importance of factor**	**Impact direction of factor:** Fostering + Hindering -	**Source** (SETFIS INT; CINA; RBG; GI/ES Mapping)
70. Do global environmental crises **such as global warming or biodiversity loss affect the innovation? If so, how?**		Climate change, part of larger development (e.g. megatrend, past event, pressure)			D6.2, WP4.2 (IP) SETFIS INT 1 SETFIS INT 2
71. What would be an external threat **to the innovation? (social, political, economic)**		External threat			SETFIS INT 1 SETFIS INT 2
72. How could the innovation be affected by external markets**?**		External markets (Focus on regional solutions)			SETFIS INT 1 SETFIS INT 2
73. Have positive/negative externalities**, even a transfer of the innovation, been recognized? If so, which ones? improve**		Spill-over effects			SETFIS INT 2
74. Anything else important to know about external influences?		Additional			

Dimension 7 –Improvement of Governance Innovation Process					
This set of questions focuses on the possibilities to upgrade and/or to upscale the innovation in the future, and how these possibilities can be influenced.					
Question	**Answer**	**Factor (and additional factors mentioned)**	**Importance of factor**	**Impact direction of factor: fostering: + hindering: -**	**Source (SETFIS INT; CINA; RBG; GI/ES Mapping)**
75. What is your vision **for the future of the innovation?**		Vision (long-term)			D6.2, CINA SETFIS INT 1 SETFIS INT 2
76. How can the innovation be advertised to increase social knowledge/acceptance**?**		Social knowledge			D6.2, CINA
77. What are the upcoming decision and short term goals**?**		Short term goals			D6.2, (D5.2) SETFIS INT 2
78. Have you noticed specific learning curves **(increase of learning through experience) during the whole development of the innovation? How has it been noticed?**		Learning curves			D6.2 SETFIS INT 1 SETFIS INT 2
79. Are definitions of goals, problems and visions **along the management of the innovation** collectively understood**? improve**		Shared definitions of goals, problems, visions			D6.2, WP4.2 (IP) SETFIS INT 1 SETFIS INT 2
80. Which radical choices **to be decided in the future that effects the innovation? What about the past?**		Radical Choices			D6.2, WP4.2 (IP) SETFIS INT 1 SETFIS INT 2

81. What needs to be changed in order to create opportunity structures and include capable agents **(e.g. politicians, investors)? Adapt wording**		Opportunity structures and capable agents			WP4.2 (IP), CINA SETFIS INT 1 SETFIS INT 2
82. What are other factors/ processes/ actors/ policies/ constraints that should (not) be changed, added, deleted, etc. to improve the future development of the innovation?		Additional: Networks			

Source: Adapted from Sorge and Mann (2018) and further elaborated

Annex 2: The matrix for scenarios development

Table 6: The matrix for scenarios development

Scenarios / Aspects	**Scenario A**	**Scenario B**	**Scenario C**
Actor configuration			
Actor relations, challenges			
Governance arrangement			
Governance, political challenges			
Organisational embedding			
Organisational challenges			
Business model			
Business challenges			
Role of citizenry			
Role of technology & science			
Technoscientific challenges			
Discourse context			
Actors fuelling controversies			
Key trends			
Uncertainties			
Shock events, interferences			
Future prospects			
Links to other IRs			
Examples, paragons elsewhere			
Degree of sustainability of innovation			

Source: Adapted from Schleyer (2019) and further elaborated

Annex 3: Info sheet about behavioural experiment (RBG): reconfiguration of innovation factors for prototype development

Rationale of the approach and the need within the InnoForESt innovation region

InnoForESt innovation regions (conceptualised as social-ecological systems, SES) are characterised by manifold, sometimes diverging uses of forest ecosystem services (FES), such as extraction, recreation, preservation or education. These uses are driven e.g. by depopulation, market pressures and ecosystem dynamics (e.g. climate events). FES are considered as public or common goods facing diverging individual and societal interests affecting the quality of ecosystems and well-being of the communities. This may result in overuse, degradation or unsustainable behaviour, creating also barriers for cooperation, economic profit and innovative business initiatives.

In order to get a better understanding of the role and the impact of key innovation factors for the regions, we have designed a behavioural [lab] experiment in the form of a Role board game (RBG). The main question to be addressed by RBG is:

How to create conditions to enable innovations for sustainable use and well-being in innovation regions under the diverging interest of FES users in a long term?

Combinations of key innovation factors with scenario options are tested for sustainable FES provision in regions concerning fundamental policy interventions, e.g. strict regulation vs. payments for ecosystem services scheme, business incentives and external risk factors, such as climate event, depopulation, migration, market etc.). RBG will allow testing stakeholders' specific behaviour for resource use, and innovation activities, to create economic incentive, knowledge and social value (will need to be discussed specifically for innovation regions). We argue that this will help to set conditions for successful development of policy and business innovations in InnoForESt innovations regions and to foster collaboration on FES provision for sustainability among stakeholders in a long term.

The proposed behavioural experiment (RBG) undertaken under the Task 3.2 and 3.3 of WP3 follows a transdisciplinary approach and aims for a co-production of empirical and theoretical knowledge among participating scientists and stakeholders. It contributes to InnoForESt objective 2: Understanding success factors of novel policy and business models. The method allows testing innovation factors and stimulates learning process on the functioning and impacts of governance innovations also across scales (objective 3), addressing policy recommendation (objective 4). The set of governance and business innovation factors (following D.3.1.) to be further complemented by and for specific innovation regions' needs).

RBG design and process

The proposed experimental session builds on Cardenas et al. (2013) and Castillo et al. (2011) as an interactive agent-based model arranging for repeated interaction and learning in real-world situations. It contributes to testing the effectiveness of incentives provision for the sustainable production of FES and the acceptance of such an intervention by FES communities (Kluvankova et al., 2019). The session intends to create a situation in which a group of five FES users make decisions about the use and management of a forest for FES provision as a governance innovation, and are confronted with fostering or hindering context conditions (local climate, economy, governance, innovation potential, etc.) and stakeholders' interests. Stakeholders will face change in conditions/factors (individual/collective action, diversity of rules, innovation factors, external events and disturbances etc.) and will be able to observe/test what conditions lead to successful collaboration for sustainable FES provision in their specific contextual conditions for well-being of their communities/region (will need to be discussed specifically for innovation regions). One stakeholder of the game will be representing an authority (e.g. national park, regional office, government, bank etc.) external to forest use but with regulatory and monitoring power. This approach will create a space to test innovation activities for prototype development (reflecting scenarios as preferred development options for the innovation regions). The game consists of two optional treatments. Each treatment has two stages (two parts with 10 rounds to play with changing conditions). One group plays only one treatment. Both treatments have an identical first stage, with certain FES without any innovation in place. In the second stage, treatments are different in factors that may affect decisions and innovations and thus leads to behavioural change of stakeholders.

Treatment 1: concerns the **variety of motivations** that make innovations attractive for stakeholders to participate and support FES provision in a long term (**state regulations/market payments for ecosystem services or a business innovation incentive**). It is here where the preferred vision for innovation development may be implemented.

Treatment 2: focus on the **governance innovation, when the forest is affected by an external disturbance** (climate event, market pressure etc.). Stakeholders can decide about the introduction of new regulatory rules, such as monitoring and sanctions, and they can collaborate on development of innovative social rules. Please see Table 7 for overview of the game logic. After playing, stakeholders will be asked to take part in a short survey to clarify reasoning of their decisions during the game, their motivations and their reflections on the game design. At the same time, calculations and graphical interpretation of the game are prepared to show the stakeholders their decisions during the game. Then, stakeholders are invited to a focus group discussion to discuss main findings and game implications for their innovations in the regions. Last minutes of the session are allocated for the stakeholders' payoffs that are based on their individual results from the game (in form of financial/material rewards to the stakeholder part is fixed and part is based on their individual decisions during the game).

***Table 7**: The overview of the InnoForESt RBG logic*

<table>
<tr><th colspan="4">Basic parameters of the game:</th></tr>
<tr><td colspan="4">➢ in each round, group of 5 stakeholders make a decision about use of the forest (forest units);
➢ communication is allowed;
➢ one external stakeholder monitors and discusses others decisions;
➢ forest quality is subject to natural regeneration of the forest (10% regrowth);
➢ probability and consequences of external disturbances (e.g. climate event, market pressure etc.);
➢ technical maximum of FES use for each player/stakeholder.</td></tr>
<tr><th colspan="2">TREATMENT 1 – EFFECT OF PAYMENTS</th><th colspan="2">TREATMENT 2 – EFFECT OF RULES</th></tr>
<tr><th>Stage 1</th><th>Stage 2</th><th>Stage 1</th><th>Stage 2</th></tr>
<tr>
<td>➢ Basic parameters of the game
➢ No social rules are set.
➢ Game starts with 100 units (trees, forest quality, habitats, etc.)</td>
<td>➢ Basic parameters of the game
➢ Game starts with 100 units (trees, forest quality, habitats, etc.)
➢ Stakeholders vote for preferred innovative element for FES management
Innovative elements:
Options for FES management:
a) business innovation;
b) payments for ecosystem services (market);
c) (state) compensation.</td>
<td>➢ Basic parameters of the game
➢ No social rules are set.
➢ Game starts with 100 units (trees, forest quality, habitats, etc.)</td>
<td>➢ Basic parameters of the game
➢ Game starts with 80 units (trees, forest quality, habitats, etc.)
➢ Stakeholders vote for preferred social rule - innovative element for FES management
Innovative elements:
- inspection and sanction for regulation of usage;
- selection and development of rules:
a) top-down regulation (limited usage of the forest);
b) rotation scheme (limited number of stakeholders can use the forest)
c) self-organisation (own rules development (based on discussion))</td>
</tr>
</table>

Steps of the experiment (RBG):

The total time needed for the experiment (RBG) is about 2 hours, consisting of:

1) Explanation of the rules (15-20 minutes).
2) Game playing (60 minutes).
3) Short survey on decision reasoning / calculation of the group results (5 minutes).
4) Focus group discussion: game results and comparison (25 minutes).
5) Payment of earnings to stakeholders (5 minutes).

Benefits for stakeholders

The RBG is meant to test combination of innovation factors in real-world setting and is part of prototype development for governance and business innovations. It enables stakeholders from innovation regions to test different innovation approaches and factors, learn about their effect and potential, discuss necessary context conditions, increasing collaborative capacity and trust. Key factors to be tested are e.g. use of incentives (certificates, compensation schemes, offset-banking, payments), use of control mechanisms (state, bottom-up), collaboration strategies (networks, voluntary, regulatory), and risks management. The RBG supports bringing forest ecosystem service provision from vision to reality in a sustainable, collaborative and innovative action!

Flexible RBG components and adjustments to Innovation regions:

The RBG session is based on common algorithm but allows for flexible arrangement and adaptation for each innovation region. Adapted can be:

- **the role of 6 stakeholders** can be specified in each case (e.g. networks, extraction and conservation users, students, visitors, bank, etc., depending on innovation region + networks);
- **the use of the resource** can be specified in each case (harvesting, reduction of forest quality, decrease of biodiversity/habitats, etc.);
- **Treatment 1** - offers options for modifying business innovations/prototypes towards sustainable FES provision specific to the case (based on scenarios: wood chipping, local wood furniture, recreation, education etc.);
- **Treatment 2** - offers space for design of authentic resource regime (e.g. self-organisation, network, centralized conservation, public - private partnership, etc.) dealing with external disturbance.

Requirements for science and practice partners:

- to cooperate on **translation/adaptation** of the instructions to innovation region language;
- to invite **stakeholders** for the game:

    - optimal number of games for each innovation region is 4, it means 24 stakeholders; minimal requirement is to play 2 games (to be able to cover both treatments in each country), it means 12 stakeholders;

- to arrange one **native speaking moderator/leader** of the game (a representative of science/practice partner) (in case of two parallel games 2 persons needed);
- to arrange **separated rooms** for each game;
- to **specify earnings** for stakeholders (in local currency, eventually in-kind payments – earnings will be covered from the CETIP budget).