



PHUSICOS

According to nature

Deliverable D1.5

Innovation Management Plan

Work Package 1 – Project admin

Deliverable Work Package Leader:
NGI

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Executive summary

Innovations in PHUSICOS are research results leading to new or improved products, services, methods or knowledge which create value for the user of the results. The innovation process is therefore a value chain, starting with the creation of intellectual property as research results, followed by appropriately securing or protecting the intellectual property (copyright, patenting etc), and finally exploitation of the results for commercial or academic purposes.

The purpose of this document is to outline the principles and expectations regarding management of the innovations resulting from PHUSICOS. The Innovation Management Plan addresses the innovation process, whereas specific strategic details such as Intellectual Property (IP) management and exploitation plans are the responsibility and domain of the owners of the IP (e.g. the consortium partners creating the research results).

The most essential part of the task to the Innovation Manager is to help the Consortium identify clearly the innovations each Party develops, communicate these innovations throughout the consortium and to the EU; and to encourage the Party (or Parties) owning the rights to the Innovation to make specific plans for disseminating or exploiting the results in accordance with plans developed in WP8 and presented in deliverables D8.2/D8.4/D8.5/D8.6.

Basic tools and routines for managing interactions between the Partners are provided, and the document includes an appendix intended to be updated by the Innovation Manager (as the editor), providing the consortium with a reference table tracking project results and innovations as they are identified by the Partners.

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1 Introduction

The intention of PHUSICOS is to support the adaptation of NBS technology and philosophy into the mainstream of risk management for climate change in rural areas. As a demonstration project, the primary focus will be on the demonstration of NBS solutions in practical applications, including all aspects of the process of planning, implementing and verifying performance.

While R&D yielding completely new products and services are not the main research focus for PHUSICOS, as a demonstration project PHUSICOS will integrate existing state-of-the-art methods and technologies in practical settings, and over time develop an evidence base regarding the performance of these solutions. Another important aspect of PHUSICOS is to enable up-scaling of solutions for real-world application by demonstrating application of the solutions. Through this implementation work PHUSICOS is expected to yield many innovations in the form of new ideas, concepts, knowledge, methods, processes and governance. Although new developments are not the primary focus of the research, it is however possible that the Results include new products, methods and services.

1.1 Purpose of this document

The purpose of the Innovation Management Plan is to establish common understanding, practices and expectations across the consortium for management of the innovations resulting from PHUSICOS. These practices and expectations shall be based in the legal requirements of the grant and consortium agreements, EU and national laws, and should be in accordance with academic traditions, integrity, fairness and plain common sense.

1.2 What is an innovation?

Innovation is the process of creating value by applying novel solutions to meaningful problems. A common misunderstanding is that innovation is the same as invention, however invention is the process of creating something entirely new.

In PHUSICOS we define innovations as Results or combinations of Results that provide new or improved services, products, data or knowledge which have the potential for creating value for the relevant stakeholders.

What constitutes 'Results' is specifically defined in the Grant Agreement. In simple, understandable terms: Results are any output of the project such as data, knowledge or information which are created via the projects activities.

Project Results should not be confused with 'Background', which is data, know-how or information that the PHUSICOS partners held before starting the PHUSICOS work, and which is necessary to perform the planned research program. However, Background may be necessary to fully realize the potential of the Results.

Innovations are the successful exploitation of the Results to produce tangible benefits, satisfying needs and wants of relevant users. These benefits may be in terms of societal benefits, promoting sustainability and resiliency, improved life quality as well as direct economic activity. The innovations may take the forms of techniques, methods, data or other products and services (Figure 1).

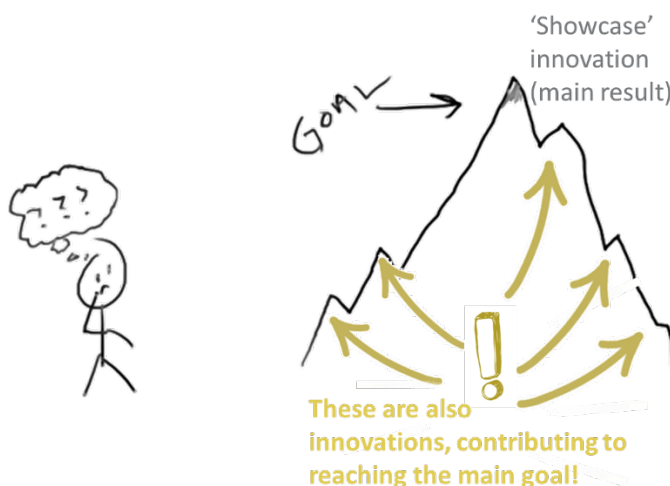


Figure 1. Defining innovation

Innovations come in all sizes. It is not only the 'big' results that are innovations, but 'smaller' results are also important! These are often building blocks for the 'showcase' results (Figure 2). Our broad definition of innovation opens for the possibility to identify a larger number of smaller innovations developed within the work packages, as opposed to a narrower definition focusing on the larger final deliverables from the work packages.

The broad definition of innovation also opens for innovations in the form of scaling (up-sizing) of existing solutions, as well as implementing of training tools and knowledge sharing techniques bridging across EU countries. Experiences and know-how gained through implementing methods are innovations as well.

In general, the PHUSICOS partners should be generous with themselves when considering the innovative nature of our own research results. Often researchers are their own strongest critics and can downplay/minimize the importance of their work - results that may seem minor or inconsequential from the perspective of the researcher producing them may have great importance for others. In PHUSICOS we encourage the individual



work packages to identify many possible innovations, and through dialog with the Innovation Manager and relevant Partners we will decide together what will be finally identified as innovations of record from PHUSICOS. Through this dialog we will also find the best strategy for dissemination, upscaling and implementing of these in the broader market.

Figure 2. Smaller innovations as stepping stones to larger ones

1.3 Examples of innovations in PHUSICOS

The PHUSICOS project has already started yielding Innovations, and several of these are presented here as examples and inspiration for the Partners. These examples will also be used in Section 5 addressing tools for upscaling and promoting innovations.

One of the Results from WP4 is a Framework Assessment Tool for evaluating or NBSs. The tool is based on selecting performance indicators relevant for a specific NBS and performing a multi-criteria decision analysis to score the NBS. The tool contains several novel Results, including a comprehensive generalized set of performance indicators grouped by Criteria and Ambits, and a multi-level weighting methodology for scoring indicators, criterion and ambits according to a bottom-up approach (Figure 3). Innovative aspects of the the FA Tool consist of scalability and adaptability to different territorial contexts and to sector-specific analyses. Moreover, a greater attention is given to social and economic impacts compared to existing frameworks. The FA tool is a Technical Innovation, and it is fully described in Deliverable D4.1. It will be tested, customized and refined through its application to both the demonstrator sites and the concept cases.

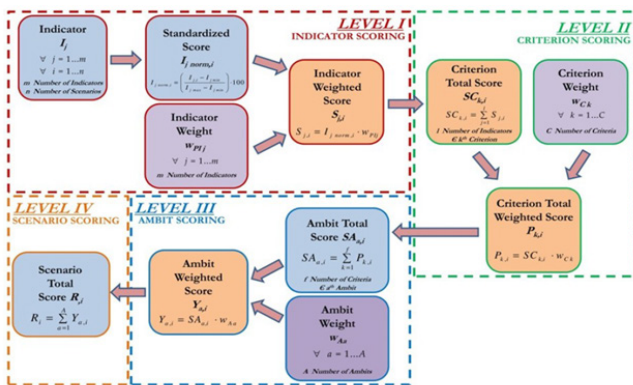


Figure 3. Illustration of the Framework Assessment Tool

Another example is a form of Service Innovation, where Living Labs are implemented as novel co-creation process for NBS and DRR. This is described in detail in Deliverable D3.1 and presented in the infographic shown in Figure 4.

A third example is a Learning Arena Innovation, where local authorities have developed a course on 'Nature Based Solutions for climate adaptation'. The purpose of the course is to provide information and education in diverse topics related to implementing NBS in public works. Relevant stakeholders include public employees responsible for processes related to technical services, agriculture, zoning and environmental management; for emergency service personnel, legal services related to land use, and for private consultants and contractors.

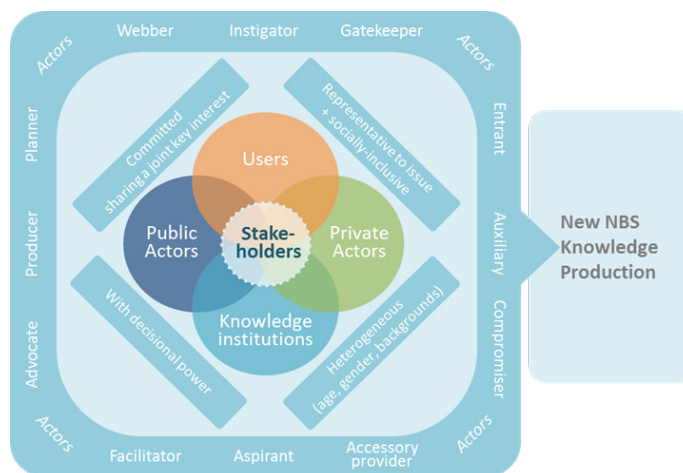


Figure 4. Service innovation in WP3

2 Role of the Innovation Manager

2.1 Intention for this role

The Innovation manager role has several central aspects or functions:

- As an *enabler*, where the intention of the role is to create structures, processes and tools to help the Partners interact with each other in developing innovations from their research activities.
- As a *promoter and educator*, to help the PHUSICOS partners understand concepts and processes related to innovation and up-scaling
- As a *sparring partner*, to provide input and dialog with the PHUSICOS partners regarding their innovations and their own strategies and plans for exploitation.
- As a *detective* to help Partners identify innovations in their own Results
- As a *caretaker*, in collaboration with the project Coordinator and PHUSICOS Steering Committee to defend the general interests of the Consortium in the case where a Partner follows a commercialisation path with their Results.

2.2 Activities and responsibilities

Figure 5 illustrates the general processes to be used in PHUSICOS to bring innovations to the market.

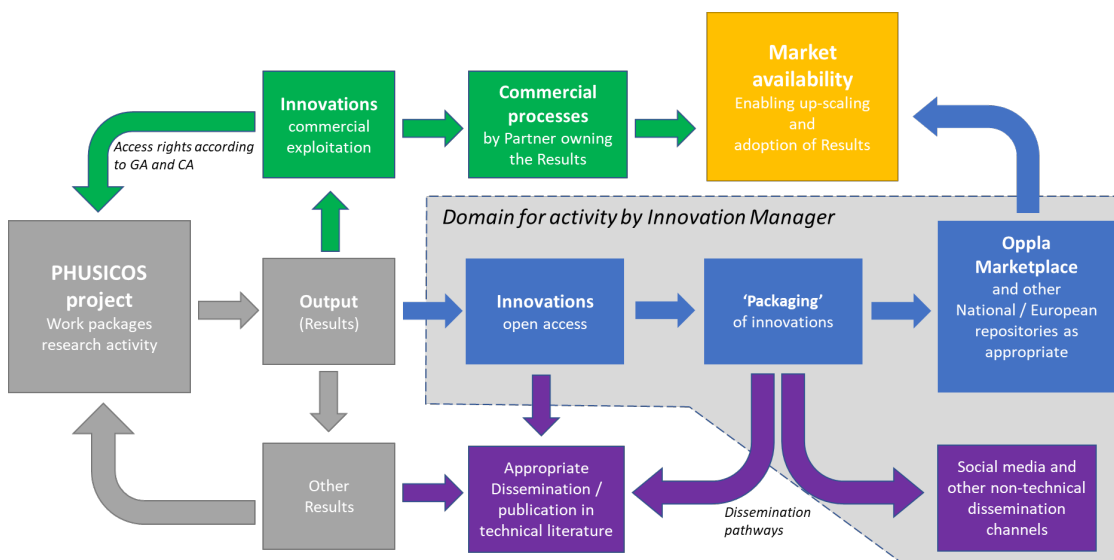


Figure 5. The innovation process in PHUSICOS

As illustrated in the diagram, the Innovation Manager's primary domain for activity is to assist the Partners in the process of identifying innovations and bringing these to the market through an open innovation pathway.

This process will require:

- Efficient/open communication channels between Work Package leaders, representatives from the Partners and the Innovation Manager
- Investment of time/effort by Partners in identifying and 'packaging' their innovations
- An understanding from the Partners that as owners of Results, they carry the responsibility and authority to make the necessary decisions regarding exploitation of their own Results. The Innovation Manager will facilitate but does not own the process or the innovations and cannot oblige the owners to take specific actions.

2.3 Confidentiality

The PHUSICOS consortium has general requirements for confidentiality within the project collaboration as described in the Consortium Agreement. The intention of this confidentiality is to prevent unintended sharing of information outside of the consortium, but that within the consortium information is shared as appropriate and necessary to perform the scope of work.

The Innovation Manager may become aware of sensitive information through discussions with Partners in the role as sparring partner to discuss strategies and plans for exploiting the innovations. To protect the interests of all parties involved in such discussions, the Innovation Manager will be obliged to maintain strict confidentiality regarding any information exchanged when requested by a Partner to do so. By strict confidentiality it is meant that all information exchanged will be kept between the Innovation Manager and the Partner, and no other Partners within the consortium shall be given access to this information by the Innovation Manager.

3 Results and Innovations in PHUSICOS

Results are product of the research activity. The challenge is to identify the innovations within the Results and encourage activities to bring the innovations into a broader use in the market. This requires the consortium to:

- Identify and define Results as they are produced
- Decide which results can be identified as project innovations
- Encourage the owners of the Results to develop a plan for disseminating or exploiting these, and
- Provide tools and support to help scale and implement these plans.

To help in this process, the Innovation Manager will keep a log of the ideas and associated discussions/decisions regarding these. The log will be available at any time for the Partners, and it shall be updated and distributed at each project meeting.

3.1 Innovation expectations

Research results become innovations when they provide value for the relevant stakeholders. In PHUSICOS, the key stakeholders (target groups) are:

- National, European and International administrators and policy-makers
- Local, Regional and National practitioners and entrepreneurs
- Private sector to include insurance, green banks and other businesses
- Environmental groups and other NGOs
- Academic networks working with DRR, climate adaptation and water management
- Stakeholders participating in the Living Labs approach at the case study sites and in the Policy Business Forums
- Stakeholders from other rural mountain communities which may benefit from the PHUSICOS results.

Innovations are expected to be made in five of the six technical Work Packages (WPs) in the project (classified according to Hartley, 2005):

- service innovation (WP3)
- technical innovation (WP4)
- governance innovation (WP5)
- learning arena innovation (WP6)
- product innovation (WP7)

The above WPs are tightly connected to the case study sites in WP2, and as such most of the innovations created in the WPs will have close ties to (or even originate from) these sites. Further, WPs 6 and 7 will contribute innovation building on the outcomes generated in the other WPs.

The Living Labs methodology will also provide innovation by identifying stakeholder needs as well as capture and leverage existing stakeholder knowledge in the development of innovations.

We expect substantial project results leading to specific innovations within each of these innovation actions, and in the context of the individual demonstration projects. As an ongoing project, some innovations have already been delivered. These were briefly presented in the introduction (Section 1.3).

3.2 Ownership of results

The PHUSICOS project is a collaboration among the Partners to deliver the individual and collective Results defined in the scientific proposal. Results may be developed by individual Partners, or by several partners in collaboration.

The Consortium Agreement presents a clear presentation of relevant principles for sharing and exploiting Results. The general principles can be simply stated as follows (refer to the Consortium Agreement for details):

- Results are owned by the Party or Parties producing the Results
- Background intellectual property (pre-existing results prior to PHUSICOS) is owned by the Party or Parties providing it.
- Broad access rights are granted for both Background and Results as necessary to perform the research activities described in the project work plan.
- Broad access rights are generally granted for non-commercial academic activities, e.g. education and research.
- Access rights for Results/Background necessary for commercial exploitation are to be negotiated between the interested Parties (those that own the IP and those interested in exploiting it). Negotiations for access rights should be based on fair and reasonable expectations.

3.3 Third Party contributions

An important part of PHUSICOS is the participation of local communities, businesses and other organizations in the demonstration projects and in the Policy Business Forum (PBF). This involvement may include activities in all aspects of implementing an NBS, for example construction, operation and assessment, education, local governance, as well as inputs and ideas for further governance and business NBS innovation.

Third parties are any parties who are not members of the PHUSICOS consortium, and thus the contractual obligations presented in the Consortium Agreement and Grant Agreement do not specifically apply to their participation, contributions or innovations. The the case study sites in the Pyrenees are examples of this - the sites are 'owned' and organized by two regional organisations who are not partners in PHUSICOS.

Activities at a demonstration site that will involve PHUSICOS in any way must be agreed between the third party and the PHUSICOS partner responsible for the demonstration site. The Grant Agreement describes obligations and requirements for establishing activity with third parties, and care needs to be placed on the establishment of agreements regulating access rights and disclosure of information.

However, we must be anticipated that third party organizations may also develop technical results and innovations because of their cooperation with PHUSICOS or their activities at a PHUSICOS demonstration site. While these results are not PHUSICOS results directly, it should be acknowledged that PHUSICOS contributed to the innovations through collaboration at the demonstration sites and the Living Labs concepts.

4 Publish or patent?

In the broadest sense, a Partner can choose between two paths: an open access philosophy embracing open innovation and traditional dissemination (e.g. publication and similar); or commercial processes to exploit the innovations for economic purposes. Partners may use the Innovation Manager as a 'sparring partner' to help in this process, however ultimately the decisions made are the responsibility of the owner of the Results. The Innovation Manager will also work to follow up the interests of the PHUSICOS consortium during these processes.

Note though that in practice we may have elements of both, e.g. a combination of open dissemination and commercial exploitation, particularly when it is an academic organisation following a commercial exploitation path for their research results.

Results (and innovations) are intellectual property (IP). There are different types of protection for IP depending on the path chosen:

- Publication of research creates provenance (e.g. who created the Results), formal IP protection through copyrights, and helps to ensure that the Results reach a broader audience and are taken into use, while providing appropriate credit to the researchers and research organisations who have produced the Results.
- Legal protection, for example patents, copyrights, trademarks, create legally defined rights for the disposition and exploitation of IP. Exploitation of IP may include economic instruments like licensing or royalties for access to the IP. The Results reach a broader audience in the form of products and services.

As mentioned above, these are not mutually exclusive: academic interests and commercial interests can also be combined. As an example, an improved design method for a type of NBS described in a journal article (academic dissemination) could be the basis for experts and consultants to develop commercial services implementing the NBS design. Specific solutions, implementations or new developments may form the basis for patents or copyrights.

The Partner creating the Results owns them and therefore has the right and responsibility to decide how to manage dissemination and/or commercial exploitation of their Results while fulfilling their overall contractual responsibilities of the PHUSICOS project. However, actions taken by one Partner may impact the plans and opportunities for other Partners, therefore the Consortium Agreement lays out requirements for notifying the rest of the Partners of the intent to publish, disseminate or otherwise exploit project Results. Refer to Section 4.3.

4.1 Open Access/Open Data = Open Innovations

The PHUSICOS consortium has proposed that the primary focus in the consortium will be on Open Access/Open Data dissemination:

All peer-reviewed publications generated in PHUSICOS will be provided in Open Access (OA) following the 'Guidelines on Open Access to scientific publications and research data in Horizon 2020', either in green or, in some cases, gold OA as well as other methods acceptable to the EU which potentially become available during the project period. PHUSICOS newsletters, policy briefs, videos, guides and reports will be made available on the PHUSICOS website. Scientific output (data and knowledge) will be centralized in the Open Access Infrastructure for Research in Europe (OpenAIRE), which will also serve as an entry point for linking publications to the underlying research data.

Reference: PHUSICOS scientific proposal

Public dissemination may take many forms, for example training programs and information, social media, popular press etc. Results in the Public Domain do not affect IP (e.g. the ownership of the results), but grants access rights to use the results in accordance with academic traditions for acknowledgement and citation or other applicable laws (for example copyright).

4.2 Commercial exploitation

While PHUSICOS results will preferably be disseminated to the public domain as Open Access/Open Data, this is only a preference and not an obligation. For some results a Partner may find it appropriate to establish Intellectual Property Rights (IPR) for example via patenting. This is a decision of the Partner owning the results:

Each beneficiary must examine the possibility of protecting its results and must adequately protect them — for an appropriate period and with appropriate territorial coverage — if:

(a) the results can reasonably be expected to be commercially or industrially exploited and

(b) protecting them is possible, reasonable and justified (given the circumstances).

When deciding on protection, the beneficiary must consider its own legitimate interests and the legitimate interests (especially commercial) of the other beneficiaries.

Reference: Grant Agreement Section 27.1 Obligation to protect the results

Commercial exploitation is the process of creating an economic activity based on the Results, for example:

- Integration with an existing product/service
- Consultancy and advising
- Transfer of results to a third party / spin-off company
- Licensing of results

Exploitation is the means for application or use of the project innovations, and WP8 will include a specific focus on exploitation of the results to be summarized in an Exploitation Plan (Deliverable D8.6).

Commercial exploitation of results by a Partner is a complex process which will require the Partner to obtain its own legal and strategical support. The commercialization process is outside of the scope of PHUSICOS. The Innovation Manager may function as a sparring/discussions partner in the process, but with the full understanding that the Innovation Manager's primary purpose is to follow up the consortium's interests regarding access rights as needed to complete the scope of work of the PHUSICOS

project, and which are afforded the consortium by the Grant Agreement and Consortium Agreement.

4.3 Notifications to protect legitimate interests

Publishing Results or initiating commercial processes (like patenting) by the owning Partner (or Partners) may impact the legitimate interests of other Partners in the consortium. For example, publication of Results by one Partner may have a negative impact on a patent process initiated by another Partner. Another example may be a publication that does not include all Partners who have contributed to the material published.

To address this, the Consortium Agreement establishes requirements for issuing notifications to the other Partners regarding intent to publish. Notification is to be given at least 45 days in advance.

5 Tools for promoting PHUSICOS innovations

5.1 Ambitions and goals

A specific goal within the PHUSICOS project is to facilitate up-scaling, wider dissemination and adoption of the solutions and knowledge produced in contexts outside of PHUSICOS. Tangible Results and innovations will be made available for public use or provided as commercial services to the market. Ideally, the success in meeting this goal would be directly measured via selected indicator parameters measuring the uptake of PHUSICOS innovations in other projects, activities and contexts. Indicator parameters could be defined as measurable quantities, for example the number of NBSs constructed; number of countries implementing policy documents etc. However, this uptake will take time, and it will most likely be difficult or impossible to measure this effect quantifiably within the timeframe of the PHUSICOS project.

The alternative is to set ambitions and goals related to enabling up-scaling, dissemination and uptake of the PHUSICOS results, such that this can continue to occur after PHUSICOS is completed. Enabling this will be achieved by:

- identifying PHUSICOS innovations,
- preparing these for further dissemination by 'packaging' them in a format or structure that is easily accessible for use by others,
- making the 'packaged' innovations available through public forums and knowledge repositories, (alternately as commercial services), and finally
- 'marketing' the innovations via social media/non-scientific fora, and encouraging the Partners owning the Results to publish these in traditional technical / scientific fora (journals, conferences).

Note: The Innovation Managers role will be to facilitate this process, including persuading/coaching/encouraging/advising as needed, but ultimately it will be the

Partner owning the Results who have the responsibility to decide how their Results will be disseminated and promoted to the market.

Our ambition:

- Each work package will contribute with at least one innovation from their Results. Ideally the work packages should produce several.
- All identified innovations will be categorised by the Results owner as either
 - an open access innovation (preferred choice for PHUSICOS results)
 - a potential commercial process (at the owner's discretion)
- All open access innovations will be 'packaged' (ref. Section 5.2). Commercial processes will be handled outside of PHUSICOS; but access rights will be maintained as required by the GA and CA.
- All 'Packaged' innovations will be made available and promoted in open fora
 - published in the Oppla Marketplace and other national and European registers if appropriate (ref. Section 5.3 and 5.4)
 - promoted via social media, with mentions on at least three platforms (Twitter, LinkedIn, Facebook, Instagram, Pinterest etc).
 - The PHUSICOS WP7 activities will also yield a publicly accessible database of NBS for disaster risk reduction. This database serves several purposes: it represents several innovations; it is a public dissemination channel, and it will be cross-referenced from the Oppla Marketplace and other registers providing mutual promotion of these tools.
- Result owners will be encouraged to produce additional publications describing their innovations or presenting applications of their innovations as a means of increased technical dissemination

Measurable parameters:

- Number of entries published on Oppla Marketplace (minimum 1 per work package)
- Number of postings on social media (minimum 3 mentions per entry in Oppla Marketplace)

5.2 Product/service packaging

Results that have been identified as innovations need to be prepared for further utilisation, dissemination and up-scaling. Essentially this consists of 'packaging' the Results together with other necessary information and structured in a way that a target user can access the deliverable and will also have the necessary information to successfully use the Results.

For example: Consider the example given in Section 1.3 consisting of a new method developed in PHUSICOS WP4: The Framework Assessment tool. 'Packaging' of this Result may consist of:

- The PHUSICOS deliverable describing the method (a document)
- The spreadsheet tool indicating the full matrix of ambits, criterion and indicator parameters (a spreadsheet)
- An example using one of the PHUSICOS demonstrator sites (a spreadsheet showing the reduced matrix specific for the site, with weightings and calculations)
- A list of key parameters suitable for identifying the content and purpose of this Result, for example language, license terms (e.g. open source), contact details, etc. These will be used to identify the Result when it is posted in various databases.

As another example, consider the deliverable D3.1 describing the implementation of the Living Labs as a novel co-creation process. 'Packaging' of this result may consist of

- a PDF of the deliverable document D3.1
- contact information for the organisation creating the Result
- A list of key parameters suitable for identifying the content and purpose of this to be used to identify the Result when it is posted in various databases.

An example of a scientific Result 'packaged' for further dissemination and implementation is given in Figure 6 (as presented in Oppla; the featured results are not from PHUSICOS):

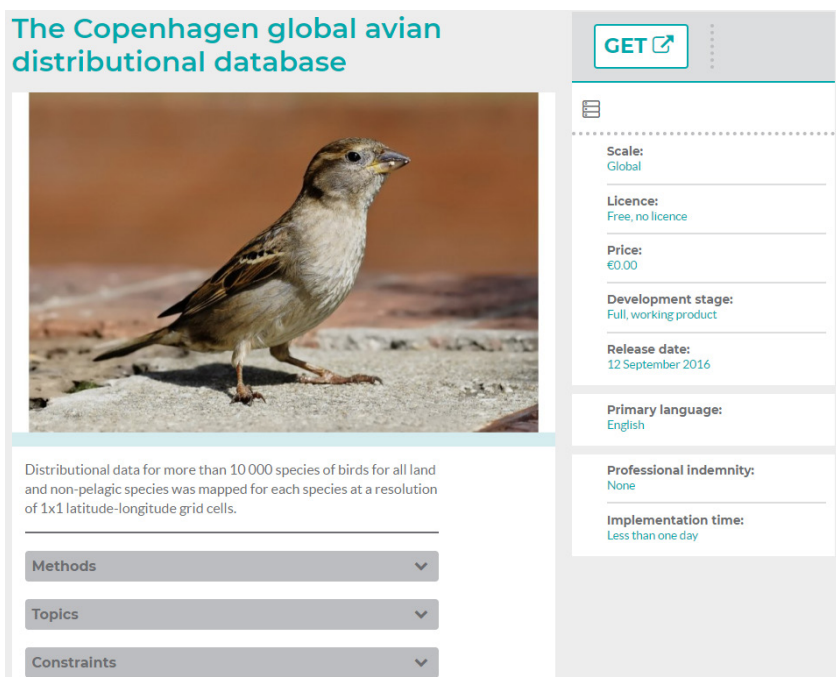


Figure 6. Illustration of a 'packaged' result. (Entry in the Oppla Marketplace, not a PHUSICOS research result)

Finally, the host locations of the 'packaged' deliverables needs to be identified - essentially the location where the Result Package is stored and from which the Result can be accessed by anyone interested. This host location may be the owners own website

or data repositories, a commercial hosting site, uploaded as a complete product to national or international repositories etc.

The Innovation Manager will encourage (and if necessary assist) the Partner owning the Result in identifying necessary components or elements needed to 'Package' the results, and in publishing the package on appropriate databases or repositories.

5.3 OPPLA Marketplace

One highly relevant example of a data repository is Oppla, which is the EU Repository of Nature-Based Solutions, located at the web address: <https://oppla.eu>.

The Oppla web site description states that

- It provides a knowledge marketplace, where the latest thinking on natural capital, ecosystem services and nature-based solutions is brought together.
- Its purpose is to simplify how we share, obtain and create knowledge to better manage our environment.
- Oppla is an open platform that is designed for people with diverse needs and interests - from science, policy and practice; public, private and voluntary sectors; organisations large and small, as well as individuals. All are welcome and have a part to play in our community. *(Direct citation from the website)*

One of the features is the Oppla Marketplace (Figure 7), which Oppla describes as:

A knowledge supermarket where you can obtain guidance, software, data and other useful resources - as well as promote the outputs of your own project or network. Materials in the Marketplace may be of any format, such as images, documents, data, spreadsheets etc. These product types are searchable using a variety of filters and keywords. *(Direct citation from the website)*

The Results from PHUSICOS, once suitably 'packaged' as products, services, data or knowledge (Ref. Section 5.2), can be uploaded to the Oppla Marketplace to enhance dissemination, adoption and implementation.

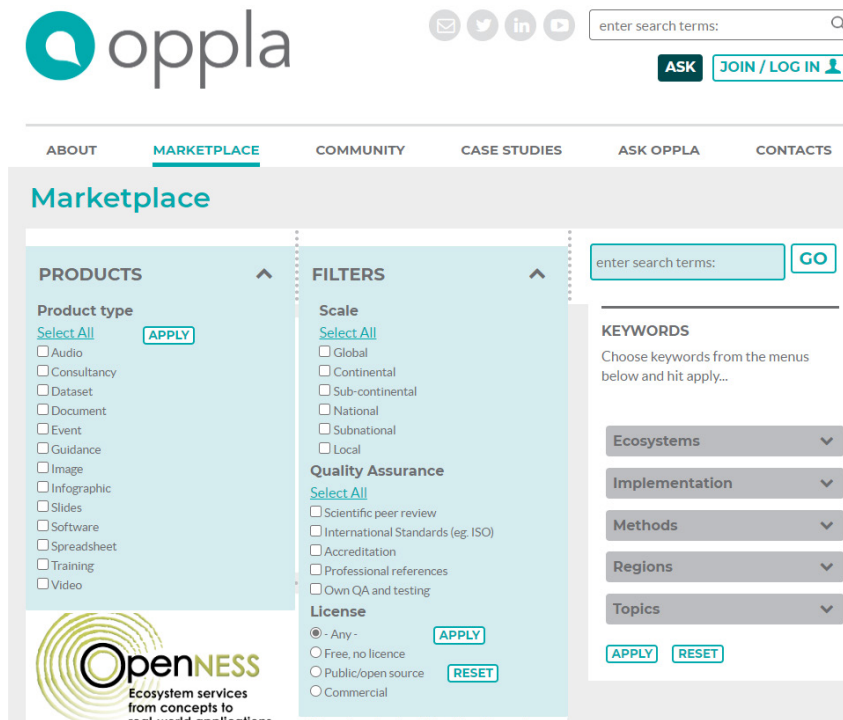


Figure 7. Example illustrating the Oppla Marketplace

5.4 National and European registers

The 'Packaged' Results may also be posted in National or European registers, repositories or databases as appropriate for the specific Results. The Innovation manager will work with the various Partners and Work Package leaders to identify additional appropriate registers, for example as part of the European Open Science Cloud (EOSC), the OpenAIRE initiative, or other similar research and innovation initiatives.

National databases may also be relevant repositories for publishing innovations. For example, within Norway the governmental 'Norwegian Digitalisation Agency' is responsible for maintaining a publicly accessible catalogue over open data sets in Norway (Figure 8). This database would be a potential repository for any Results in the form of datasets produced by NGI within PHUSICOS.

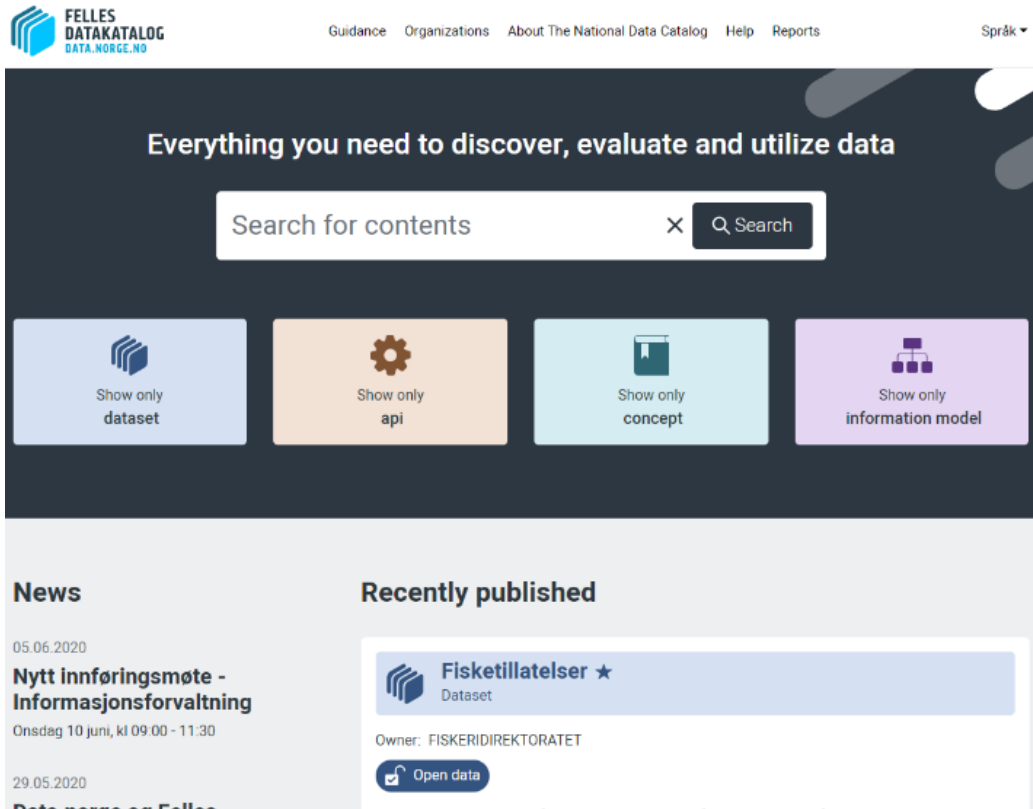


Figure 8. An example of a national open access data repository (Norway)

6 Upscaling

6.1 What we aim to achieve

When upscaled, our innovations lead to changes in methods and habits of people and societies over time. These innovations create ‘value’ which can be either (or both) economic and other forms of value (social, environmental, cultural, quality of life, ethical etc.)

Simply expressed, upscaling takes a niche innovation, known only to a few and with little specific tangible value, to something that is accessible, available, familiar and can be broadly applied, creating value for the parties involved in its implementation and use.

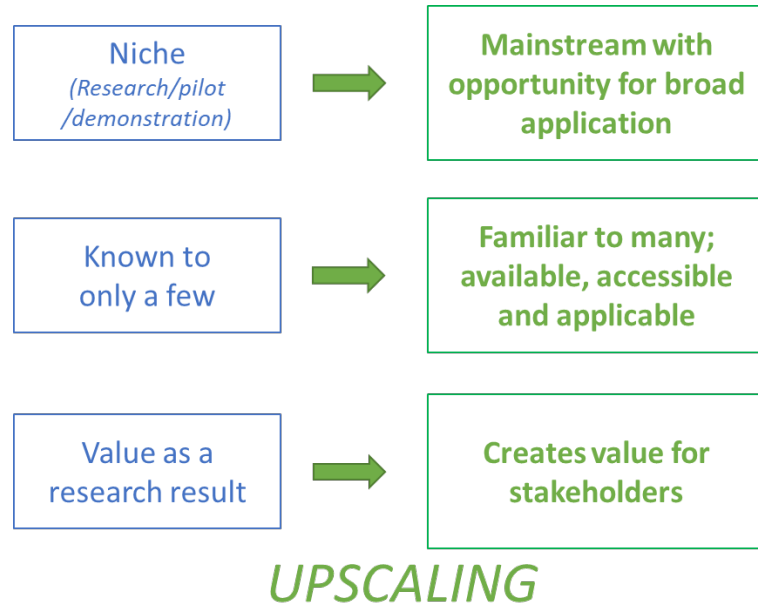


Figure 9. Describing upscaling

6.2 Upscaling within PHUSICOS

When planning an upscaling strategy start by considering the overall vision; e.g. what are the ultimate goals for your results:

- What is the full potential for value creation...and what type of value can be created?
- Who are the stakeholders and what are their interests?
- How can we extend the reach of this innovation across Europe?
- What is the best way to make this innovation broadly available?

Reaching this vision for upscaling may in some cases be relatively straightforward and quick, but more often it will be a complicated and time-consuming process. In many cases the process will rely on factors, elements or actors outside of the project's control. For example, incorporating a design method into a national or international standard may require years of committee work.

Therefore, it is important to define appropriate sub-goals (milestones) that positively contribute to the overall vision for upscaling of the innovation and identify those milestones that are feasible to achieve within the scope of the PHUSICOS project.

6.3 Scale

We can define the reach of our innovations using a nested scale: local, regional, national and European, and define upscaling within this scale in two ways:

- **Literal:** Expanding the reach of a product, service or knowledge to increasingly wider extents. E.g. upscaling from a niche solution at one location, to something that is well known and can be easily implemented at any location across Europe.
- **Figurative:** Generalizing the nature of a product, service or knowledge, such that it becomes relevant and valuable for larger contexts. E.g. from being a local skill, to becoming a European standard or recommended practice.

6.4 Stakeholders

In PHUSICOS we define Stakeholders as persons, groups and organizations with an interest or "Stake" in an issue, either because they will be affected or because they may have some influence on its outcome. (*PHUSICOS Deliverable D3.2, TUM*).

We can define a coarse segmentation (grouping) of stakeholders for discussing upscaling:

Group	Characteristics	General interests
Companies	Private companies and consultants providing services, such as construction, supply of materials, service etc.	Providing services and solutions creating value for the customer and the company. This group needs efficiency, quality, risk reduction.
Lobbyists	Public interest groups consisting of groups of citizens or organizations, dedicated to pushing forward specific interests, needs or wants (interest groups/ advocacy groups/ coalition groups)	Promoting the interests of a segment of society they represent. This group needs information and evidence.
Authorities	Government bodies, public agencies or regulatory agencies serving citizens and companies.	Implementing policy and actions to manage, protect and improve society.
Experts	The scientific community	Research and development to improve knowledge and provide knowledge-based services to other stakeholders.
Citizens	Individual citizens or persons who have their own personal interests and needs, not belonging within other groups	

6.5 Needs and opportunities within the PHUSICOS work packages

The following sections present examples of innovation expectations for the various work package. Each table presents the overall vision for upscaling innovation, followed by a more specific presentation of goals and actions that may be taken within PHUSICOS to contribute to reaching this overall vision.

6.5.1 WP1 Administration

Innovation expectations	As an administrative work package this would normally not be expected to produce innovations. However, the global pandemic has forced the PHUSICOS project leadership and the project consortium to adapt to new ways of managing and executing an international collaborative research activity. These kinds of innovations occurring in all EU research projects.
Stakeholder interests	Experts (researchers) participating in collaborative projects need solutions and methods to effectively execute research without physical meetings or face-to-face interactions.
Potentials for value creation	At all scales: significant reductions in travel costs and CO2 emissions by implementing policies for video meetings and a virtual collaboration forum for sharing of project information in EU projects. While a necessity under a pandemic, at other times this offers a more sustainable work paradigm.
Upscaling needs	Experiences and solutions implemented across EU research projects need to be collected by central EU research authorities, analyzed and collated into guidelines or policies for conducting EU research with a minimum of physical interaction.
Challenges	Face-to-face meetings, conferences and workshops are widely regarded as important components of collaborative research and dissemination. Implementing expectations or policies limiting (or excluding) these in post-pandemic research may be unpopular.
Time scale	Research projects initiated prior to the pandemic but active during and after the pandemic should be included in the central EU evaluation. It will require several years to gather information, process this and establish policies, guidelines or best practice.
PHUSICOS Actions and sub-goals for upscaling	Provide summary and evaluation of actions taken by PHUSICOS management to adapt to pandemic travel restrictions. To be included as a section in the the Impact Evaluation Report.

6.5.2 WP2 Case study sites

Innovation expectations	<p>Innovations developed in WP2 will likely relate to:</p> <ul style="list-style-type: none"> • specific technical issues or details related to implementing of demonstrator NBS. • Public use or access to areas mitigated using NBS • Developing new forms for cooperation and interaction between companies • Identification and removal of barriers for implementation of NBS • Legal processes (contractual, tendering, planning and approval) 			
Stakeholder interests	<p>The most relevant stakeholder groups for these innovations are Companies, Authorities, and Lobbyists. Companies need new solutions, but also the underlying processes for tendering and construction which reduce risk and improve efficiency. Authorities need solutions, an industry capable of providing them, and efficient processes to implement these. While Citizens are important beneficiaries, they are not directly involved in business or legal processes to implement NBS once decided by Authorities. (However, they are essential during planning).</p>			
Scale:	Local	Regional	National	European
Potentials for value creation	<p>At local and regional scale, the Companies involved in the pilot can create value through marketing of their experience and solution and offering the services as alternatives in traditional construction activities. New partnerships can be explored.</p>		<p>At National and European levels, original ideas or solutions may be patented, branded or licensed as appropriate. New solutions may be encoded in national or European standards.</p>	
Upscaling needs	<p>Dissemination/information regarding technical developments (marketing), private-public segment. Local/regional Authorities to be made aware of new solutions. Companies to create alliances or ventures to supply.</p>		<p>Lobby groups and politicians need information and motivation to bring the new solutions into the discussion for national/European standards and recommended practice.</p>	
Challenges	<p>Business: Competition between individual companies creating need for protection of know-how and solutions may inhibit general adaptation of solutions.</p>		<p>Proprietary solutions limiting implementation in standards. Lack of political will to engage and lift topic.</p>	
	<p>General challenges at all levels are lack of knowledge about NBS and their benefits and co-benefits, scepticism regarding their efficiency (which relates to the lack of knowledge), plus lack of political willingness to push for NBS, and take battles with land owners who want compensation for loss of land (NBS can be area-demanding)</p>			
Time scale	<p>Relatively short. Companies can implement PHUSICOS developed solutions directly into their own core business activities at any time.</p>		<p>Long term. Requires track record and acceptance in the industry before encoding in standards/practice.</p>	
PHUSICOS actions and sub-goals for upscaling	<ul style="list-style-type: none"> • Identify specific innovations developed at case sites. Clearly define these and identify contributing parties (CPs) • Decision by CPs: shall these innovations be disseminated in the public domain, or shall they be upscaled through commercial/business processes by the CPs. 			

- For public dissemination: WP to create an appropriate description of the innovation and publish through the Oppla Marketplace.
- Disseminate 'success stories' via social media or popular information channels.
- For commercial/business processes: Obtain a statement of the intended upscaling strategy from the CPs and publish this in the Impact Evaluation Report.

6.5.3 WP3 Service innovation

Innovation expectations	Innovations will be related to the establishment of Living Labs, stakeholder knowledge mapping and co-design for case study sites. This WP will also deliver a scheme for monitoring and evaluating stakeholder participation and user satisfaction for the living lab experiences			
Stakeholder interests	The involvement of stakeholders through living labs depends on the nature and extent of the NBS. As such, in a Living Labs process potentially any (all) of the stakeholder groups may be involved in a participatory role. However, the innovations in this WP relate to the <i>implementation</i> of the Living Labs concept for co-design, and thus the primary interest groups are Authorities and Experts who will be users of Living Labs when implementing an NBS.			
Scale:	Local	Regional	National	European
Potential for value creation	Better solutions through co-design and involvement of relevant stakeholders in the participatory living labs scheme. Toolbox and methods for supporting this process can be applied at any NBS project across Europe. (Literal upscaling). Potential opportunity for Company (consultant) to provide LL implementation and execution as a commercial service.			
Upscaling needs	Developed toolboxes and methods to be made available and broadly marketed for implementation at any NBS. (Literal upscaling). Availability through Oppla and other information marketplaces to ensure access and availability. Experiences and results broadly published in scientific and popular literature.			
	LL consultant will require development of business idea, and secure necessary investors to implement.		Development of National/European recommended practice for method. (Figurative upscaling)	
Challenges	For development of recommend practice: need track record. Development of track record through application and experience will be dependent on NBS construction activity across Europe, and willingness of local / regional authorities to test methodology.			
Time scale	Toolbox and supporting materials will be published in the time frame of PHUSICOS. Publication and application at new NBS projects will be longer term.			
PHUSICOS actions and sub-goals for upscaling	Create concise summaries of following products and publish on Oppla Marketplace: Methodology for applying living labs to co-design processes Toolbox for implementing the methodology Scheme for monitoring and evaluating stakeholder participation WP leader to evaluate commercial feasibility of providing consulting/advising for LL implementation/execution as a service. This evaluation and these actions to be reported as part of Impact Evaluation Report.			

6.5.4 Technical Innovation

Innovation expectations	<p>Innovations developed in WP4 may include:</p> <ul style="list-style-type: none"> • A comprehensive Framework for NBS assessment • Database/platform for monitoring and early warning • Methods for developing hazard and risk maps to illustrate flood patterns and landslides for different climate scenarios • Methods for Evaluating ecosystems and ecosystem services for alternative landscape scenarios with plan designs 			
Stakeholder interests	<p>The most relevant stakeholder groups for these innovations are Experts and Authorities: Experts as users of these tools, and Authorities as beneficiaries of the knowledge/information created.</p>			
Scale:	Local	Regional	National	European
Potentials for value creation	Tools supporting development and monitoring of NBS and Hybrid solutions, improving ecosystems	Tools for managing risk and protecting environment. While flood and landslides are in focus, other hazards can be added over time to reach a broader application base.		Input at policy level for embracing NBS in risk reduction/ecosystem management across Europe
Upscaling needs	Dissemination/information regarding the technical innovations, and development of evidence base for implementation. Toolboxes, frameworks and methods need to be clearly described in recommended practice documents to be properly tailored as a function of the audience. Business opportunities may exist for developing of tools/apps, for example GIS toolboxes for producing hazard and risk maps; or an excel-based toolbox for calculating the index parameters in the assessment framework. (literal upscaling)			Products and results from applying the tools used to develop a compelling case for Lobbyists to promote NBS solutions in DRR.
Challenges	These tools and methods can clearly be distributed via Oppla Marketplace and other fora to upscale availability and application. It is less clear if there can be developed a competitive business case for creating commercial products (like a GIS toolbox). This may require public investment for viability.			Need to develop evidence base over time, need to find appropriate special interest groups.
Time scale	Upscaling via Oppla Marketplace: short term, can be implemented immediately. Developing commercial products will require a longer period to develop a business case and secure investors.			Very long term
PHUSICOS actions and sub-goals for upscaling	<ul style="list-style-type: none"> • Create concise summary of the following and publish on Oppla Marketplace: • the assessment framework tool (AFT), including supporting worksheets/aids • monitoring/early warning database • methodology for risk map production and progressive updating. • methodology for ecosystem/services assessment • Create Information packages/news releases for the above at appropriate technical levels and release into social media • WP leader to evaluate commercial feasibility of developing apps or other supporting tools to implement FAT. Contact with GIS platform developers or similar regarding implementing Risk map methodology in professional GIS tools • Pursue scientific publication where these methods are applied <p>These actions to be reported in the Impact Evaluation Report.</p>			

6.5.5 Policy Innovation

Innovation expectations	<p>Innovations developed in WP5 may include:</p> <ul style="list-style-type: none"> • NBS in-depth case study analysis of the characteristics of successful governance models • Opportunities and barriers to NBS at the EU, national, regional and local scales, with suggested reforms and innovations • Governance innovations for the design, financing and implementation of NBS, and their applications to the concept and demonstration projects 			
Stakeholder interests	<p>The most relevant stakeholder groups for these innovations are Authorities, Lobbyists and Citizens, as many of the processes of governance are tight interactions between these stakeholders.</p>			
Scale:	Local	Regional	National	European
Potentials for value creation	<p>Suggest reforms and innovations in governance models supporting development of NBS. Appropriate for each scale</p>			
	<p>Examples and case studies of successful government models provide guidance for local and regional efforts to establish NBS. Tools and methods supporting effective governance for local/regional authorities to implement NBS.</p>		<p>New policy supporting national efforts to implement NBS and sustainable solutions.</p>	<p>New policy supporting European cooperation on R&D and innovation of NBS. European focus on sustainability and green solutions.</p>
Upscaling needs	<p>Dissemination of case studies, policy briefs and other materials demonstrating successful governance models in regions with PHUSICOS cases. Need to generalize/adapt to some degree for relevance in neighboring regions.</p>		<p>Target Lobbyists and engage segments/-groups of Authorities. Broad dissemination of policy briefs and supporting information. Generalization to be suitable in various National contexts, and pan-European.</p>	
Challenges	<p>Governance models are influenced by culture, tradition, experience. Innovations and reforms from PHUSICOS cases will need tailoring and adapting to fit as the PHUSICOS experience is upscaled to regional, national and European scales. Long timescale is required for the transformation of NBS governance</p>			
Time scale	<p>Reforming governance is very long-time scale processes.</p>			
PHUSICOS actions and sub-goals for upscaling	<ul style="list-style-type: none"> • Create concise summary of the following and publish on relevant platforms, for example Oppla Marketplace, NBS evidence tool (Oxford) or others: • Case studies analyses • Communicate findings of opportunities and barriers review concisely, with consideration to their relevance to different scales (local, regional, national, European). • Governance innovations: create separate info documents/flyers/policy briefs for major innovations or suggestion for reform. Publish as package of synthesis and information materials, including policy briefs and synthesis documents, disseminated to interest groups. • Dissemination of the above via social media and appropriate fora, for example PEDRR, EU Task Forces etc. Direct distribution to planning offices of selected regions in rural/mountainous areas where PHUSICOS results are possible solutions for implementation. <p>These actions to be reported in the Impact Evaluation Report.</p>			

6.5.6 Learning Arena Innovation

Innovation expectations	<p>Innovations developed in WP6 may include:</p> <ul style="list-style-type: none"> • Training program and associated materials regarding costs and risks of NBSs. Webinars, video etc. are envisioned. • The PHUSICOS game – A Complex Social-Ecological Simulation on NBS • Spin-off activities related to communicating and presenting solutions using new technologies, e.g. Virtual Reality (VR). 			
Stakeholder interests	<p>The most relevant stakeholder groups for these innovations are Companies and (local) Authorities. Materials may also be relevant for Citizens with ambitions or interests to enter activities in the NBS domain.</p>			
Scale:	Local	Regional	National	European
Potentials for value creation	<p>Training programs and supporting materials are geared towards local contractors and suppliers. These can be upscaled by making them easily available across Europe, e.g. local contractors at any location can access these information sources. These materials may be developed into local training programs provided by a commercial supplier of training & education.</p>			
	<p>The PHUSICOS game can be upscaled by bringing the game into a format suitable for production and distribution., such that it can be marketed and distributed across Europe. Initially developed as a 'serious' game, variants of this may be implemented as a lighter-hearted version aimed towards youth with the intention of lifting the understanding of NBS technologies, and the processes of implementing these in society. (For example, NBS solutions in popular games like SimCity).</p>			
Upscaling needs	<p>Upscaling needs consist of 3 major topics: 1) 'packaging' and distribution of training programs, materials, videos to make them easily available across Europe. 2) Increasing the available technical content (breadth, depth and extent) presented in the training materials. 3) Opportunities to bring 'training' to a wider audience than contractors and authorities, for example to Citizens (youth).</p>			
Challenges	<p>Materials developed in various languages need to be translated/produced in an appropriate language for the nation/region targeted for distribution. Alternately, English may be adopted as the standard initial production language; local translations are the responsibility of the local users. Copyrights and intellectual property may come into play.</p>			
Time scale	<p>Short term to implement upscaling of the materials developed in PHUSICOS, medium to long term to expand content. Medium to long term to implement PHUSICOS game in other formats.</p>			
PHUSICOS actions and sub-goals for upscaling	<ul style="list-style-type: none"> • Create concise summary of the training materials and videos and publish on Oppla Marketplace. Note this requires clarification of copyrights and IP. • As other language versions are created, or the material is extended, include these on Oppla. • WP leaders to consider creating and publishing video segments and information via media streaming services, for example via YouTube. • Initiate contact with professional developers of games (physical and digital) to explore idea of introducing elements of the PHUSICOS game in other products or contexts. <p>These actions to be reported in the Impact Evaluation Report.</p>			

6.5.7 Product Innovation

Innovation expectations	The main innovations in WP7 will be the development of a PHUSICOS web-based tool for demonstrating and maintaining data for NBSs and populating this with data, and the collection of data itself as created by the PHUSICOS project.			
Stakeholder interests	The most relevant stakeholder groups for this innovation are Experts and Authorities.			
Scale:	Local	Regional	National	European
Potentials for value creation	Scientific and technical evidence supporting decision-making for implementation of NBS by local and regional authorities. Baseline data for evaluating performance.		Scientific and technical evidence supporting research and development of NBS. Supporting information for policy development and governance reforms.	
Upscaling needs	<ul style="list-style-type: none"> The database requires additional evidence and results to be added as new NBS projects are developed Continued operation of the database after end of PHUSICOS, or a strategy for porting the database contents into another suitable operational database. 			
Challenges	It is "easy" to collect data (make a database) within a research program, the difficult challenge is to ensure that the database endures beyond the end of the project and continues to provide value. Technically the development of the database requires enabling tools and methods for importing, finding and presenting data that optimizes the value of the database. It must be relatively easy to add new evidence to the database; the system must be robust and there needs to be assurance that the evidence is qualified and verified.			
Time scale	Strategy for preserving the database beyond the end of PHUSICOS must be developed within the time frame of the PHUSICOS project. Adding to the evidence database should be on ongoing process.			
PHUSICOS actions and sub-goals for upscaling	<ul style="list-style-type: none"> Develop a strategy for managing the PHUSICOS database beyond the end of the project or porting the database to another data management system. 'Marketing' of PHUSICOS evidence data base via appropriate technical channels, for example via publications, scientific workshops and similar. Develop a standard acknowledgement text to be required when the evidence database is used in research. Dissemination through social media, for example LinkedIn <p>These actions to be reported in the Impact Evaluation Report.</p>			

7 Summary

The innovation management plan provides a short description of various themes and topics that must be considered when identifying project Results (PHUSICOS innovations) and when the owning Parties decide how these project Results will be implemented as practical tools or services in society.

The role of the Innovation Manager is to facilitate the process of identifying project innovations, and subsequently encouraging the owning Partners to pursue specific actions to make these available for wider dissemination, implementation and up-scaling. This will be achieved by packaging innovations and publishing them in appropriate repositories - primarily Oppla but also in National / European repositories if appropriate.



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