PHUSICOS

According to nature

Deliverable D3.6

Monitoring & Evaluation Scheme to Assess Stakeholder Participation and User Satisfaction with Living Lab Experience
Version 3

Work Package 3 – Service Innovation: Stakeholder Participation through Living Labs

Deliverable Work Package Leader:
TUM

Revision: 0 – Final Version
Dissemination level: Public

January 2022

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 776681.

Any dissemination of results must indicate that it reflects only the author's view and that the Agency is not responsible for any use that may be made of the information it contains.

The present document has not yet received final approval from the European Commission and may be subject to changes.

Note about contributors

Lead partner responsible for the deliverable:	TUM
Deliverable prepared by:	Based on Deliverable D.3.3 elaborated by Sandra Fohlmeister, Malin Tiebel and Isabel Augenstein – revisions and additions to Chapters 1, 7 & appendices by Gerd Lupp and Aude Zingraff-Hamed (TUM)
Partner responsible for quality control:	NN
Deliverable reviewed by:	Juliette Martin (IIASA)
Other contributors:	

Project information

Project period:	1 May 2018 – 30 April 2023
Duration (no. of months):	60
Web-site:	www.phusicos.eu
Project coordinator:	Norwegian Geotechnical Institute, (NGI project no.: 20180404)

Project partners:

Summary

This deliverable D3.6 *Monitoring & Evaluation scheme to assess stakeholder participation and user satisfaction with Living Labs experience, version 3* is a further elaboration of D3.3 and D3.4. The approach for monitoring and evaluation (M&E) outlined in this deliverable focuses on assessing stakeholder participation, user satisfaction in the Living Labs, their awareness and perceptions of Nature based Solutions (NBSs). The report provides the local facilitator teams of demonstrator and concept case sites with guidance to monitor, evaluate, manage and steer their Living Lab processes.

D3.6 is the final deliverable of a series of reports related to the Monitoring & Evaluation scheme to assess stakeholder participation and user satisfaction with their experiences of Living Labs. It further develops the monitoring and evaluation materials and approaches. Besides this, it elaborates on the follow up of the stakeholder´s awareness and perception of NBS. Chapter 7 and the appendices operationalize the monitoring and evaluation of Living Lab processes and their management at the case sites. Using the first report of the series of reports, the monitoring and evaluation procedures were further developed in collaboration with case study sites, facilitators and WP3 partners in an iterative way based on expressed site needs, experiences gained from the testing of materials, feedback from stakeholders as well as reflecting on the different Living Lab processes.

The report aims to address especially four target groups in their work on NBSs:

- the facilitators of the PHUSICOS Living Labs who will steer and manage the stakeholder involvement processes at the demonstrator and concept case sites
- local scientific and end-user partners as well as other Living Lab participants of the case study sites who will select, co-design and evaluate the NBSs;
- PHUSICOS project partners, such as Work Package (WP) leaders and their collaborating teams, to achieve a coherent understanding and implementation of key concepts; and finally
- a broader audience such as planning practitioners, politicians and scientists working on co-designing NBSs for climate change adaptation, land use planning, disaster risk management, and related fields, and wishing to employ Living Lab approaches to find innovative ways of developing and implementing solutions inspired by nature.

Glossary

KEY CONCEPTS, ABBREVIATIONS AND DEFINITIONS

CO-DESIGN, CO-CREATION, CO-PRODUCTION:

Co-design, co-creation or knowledge co-production can be defined as innovation process that involves end-users as "actors" instead of solely "factors" in all phases of the design process, unlike traditional top-down linear design thinking where end-users may only be responsible for reviewing or giving feedback on the design process (Voorberg et al., 2014; Evans et al., 2017).

CONCEPT CASE SITE (CC):

Small-scale case study site which serves to test specific challenging aspects of NBSs, and to study transferability of lessons learned. In PHUSICOS, the Kaunertal Valley of Austria and the Isar River watershed of Germany are designated as concept cases.

DEMONSTRATOR CASE SITE (DS):

Large-scale demonstrator case study site which serves for the implementation of nature-based solutions (NBSs). In PHUSICOS, these are situated in Gudbrandsdalen, Norway; the Pyrenees, France-Spain-Andorra; and Serchio River Basin, Italy.

EFFECTIVENESS:

Extent to which a project attains, or is expected to attain, its objectives efficiently and in a sustainable way (Gujit and Woodhill, 2002).

EFFICIENCY:

Measure of how economically the inputs of a project intervention (funds, expertise, time, etc.) are converted into outputs (Gujit and Woodhill, 2002).

EVALUATION:

Systematic examination of a planned, ongoing or completed project, which aims to judge the overall value of a project intervention and provide lessons learned for corrective action, planning and decision-making. Commonly, an evaluation intends to determine the efficiency, effectiveness, impact, sustainability and relevance of the project intervention (Gujit and Woodhill, 2002; EC, 2004).

IMPACT:

Effect of a project intervention on its wider environment, and its contribution to the project's purpose or overall goal (Gujit and Woodhill, 2002; EC, 2004). Often, the impact is expressed by the changes the target groups of a project intervention perceive.

INDICATOR:

Quantitative or qualitative variable that provides a simple and reliable basis for assessing achievement, change or performance. Indicators can be formulated on various levels, such as output, outcome or impact level (Gujit and Woodhill, 2002; EC, 2004).

KEY CONCEPTS, ABBREVIATIONS AND DEFINITIONS (continued)

LIVING LAB (LL):

A Living Lab is a physical area and interaction space, in which stakeholders form a quadruple helix innovation network of companies, public agencies, universities, users, and other stakeholders in the pursuit of collaboration for the creation, prototyping, validating and testing of new technologies, services, products, and systems in real-life contexts (based on Leminen, 2013).

LIVING LAB FACILITATOR:

A person who is in charge of facilitating and steering the local Living Lab process, which involves identifying, engaging, coordinating and monitoring stakeholders as well as pro-actively guiding the iterative knowledge exchange with a project's work packages and implementation of process outcomes (based on Van der Jagt et al., 2017).

MONITORING / M&E:

"The regular collection and analysis of information to assist timely decision-making, ensure accountability and provide the basis for evaluation and learning. M&E is the combination of monitoring and evaluation, which together provide the knowledge required for i) effective project management and ii) reporting responsibilities" (Gujit and Woodhill, 2002: A-7).

NATURE-BASED SOLUTIONS (NBSs):

Nature-based solutions are living solutions inspired by, continuously supported by and using nature. They are designed to address various environmental challenges in a resource efficient and adaptable manner and to provide simultaneously economic, social and environmental benefits (EC, 2015).

RELEVANCE:

Extent to which the objectives of a project intervention are consistent with the target group's priorities and demands (Gujit and Woodhill, 2002).

STAKEHOLDER:

All persons, groups and organisations with an interest or "stake" in an issue, either because they will be affected or because they may have some influence on its outcome. This includes individual citizens, companies, economic and public interest groups, government bodies and experts. (Ridder et al., 2005: 2).

STAKEHOLDER INVOLVEMENT / STAKEHOLDER PARTICIPATION:

Process of involving those who are affected by and thus have an interest in a defined issue. This involvement of interest groups may refer to different contents, such as planning, decision-making or monitoring and evaluation of an issue (after Hauck et al., 2016 and FAO, 1995), and happen on different levels, ranging from information and consultation to active collaboration and transferring decision-making into the hands of the public (IAP2, 2018).

Table of Contents

Figures

Tables

Appendices

1 Introduction

1.1 M&E in PHUSICOS: a multi-level approach

Deliverable D3.6 further develops D3.3 and D3.4 *Monitoring & Evaluation scheme to assess stakeholder participation and user satisfaction with Living Labs experience, version 1 and 2 respectively*. Deliverable D3.6 is a follow-up to

- D3.1 *Guiding Framework for Tailored Living Lab Establishment at Demonstrator and Concept Case Study Sites* that provides the theoretical background and project terminology for the Living Lab processes, as well as a practical guidance for the main steps to be taken to establish the Living Labs.
- D3.2 *Starter Toolbox for Stakeholder Knowledge Mapping to Co-Design Nature-Based Solutions at Case Study Sites*. D3.1 that presents comprehensive Toolbox for fostering stakeholder involvement at the case study sites. It is a steppingstone from Living Lab preparation towards implementation by assembling a comprehensive Toolbox for fostering stakeholder involvement at the case study sites.
- D3.3 *Monitoring & Evaluation Scheme to Assess Stakeholder Participation and User Satisfaction with Living Lab Experience - Version 1*, that presents the theoretical framework of the Monitoring & Evaluation Scheme for the Living Lab that will be apply within PHUSICOS project.
- D3.4 *Monitoring & Evaluation Scheme to Assess Stakeholder Participation and User Satisfaction with Living Lab Experience - Version 2*, that further develops and operationalizes the Monitoring & Evaluation Scheme for the case sites
- D3.5 *Lessons learned from the Living Labs Experience*

Building on these previous materials, the main goal of D3.6 *Monitoring & Evaluation Scheme to Assess Stakeholder Participation and User Satisfaction with Living Lab Experience – Version 3* is to present a further evolved version of the M&E following the Living Labs, ongoing co-design processes, knowledge creation and transfer at the different case study sites. To support the sites, D3.6 is a further operationalization and adaptation of the previous deliverables D3.3 and D3.4, capturing and assessing stakeholder knowledge and satisfaction with the Living Lab processes in collaboration with the different case sites. It also considers responding to the SARS-CoV-19 situation with additional or adapted approaches that reflect situations where no or only restricted in-person formats were possible.

In particular, methods to map stakeholders and their knowledge were further elaborated and additional materials were developed (see Appendices) to a) fit the needs of the different case sites and overall challenges given by the SARS-CoV-19 situation and the need for adapted timelines, b) include site inputs and needs based on experiences with the Living Labs in an iterative way, and c) integrate new outcomes such as deliverables from other work packages including WP4 and WP5.

Deliverable D3.6 intends to support the evaluation to meet targeted quality standards of Living Lab management and stakeholder involvement. It also provides approaches to capture and map stakeholder knowledge, perception and awareness of NBS and their evolution during the Living Lab processes. The theoretical foundations, operationalization and materials presented in this deliverable report form the basis to collect data and information for the final deliverable report, D3.7, on lessons learned from Living Labs experiences in relation to NBS. The revision of D3.3 and D3.4 into D3.6 focuses on the further elaboration of the procedures for assessment of the performance of the Living Labs and of user satisfaction at the different case sites. It also includes materials to support the elaboration of the final deliverable on lessons learned with stakeholder mapping, survey and interviews approaches to capture the different aspects of satisfaction with Living Lab processes as well as capturing NBS awareness and perception.

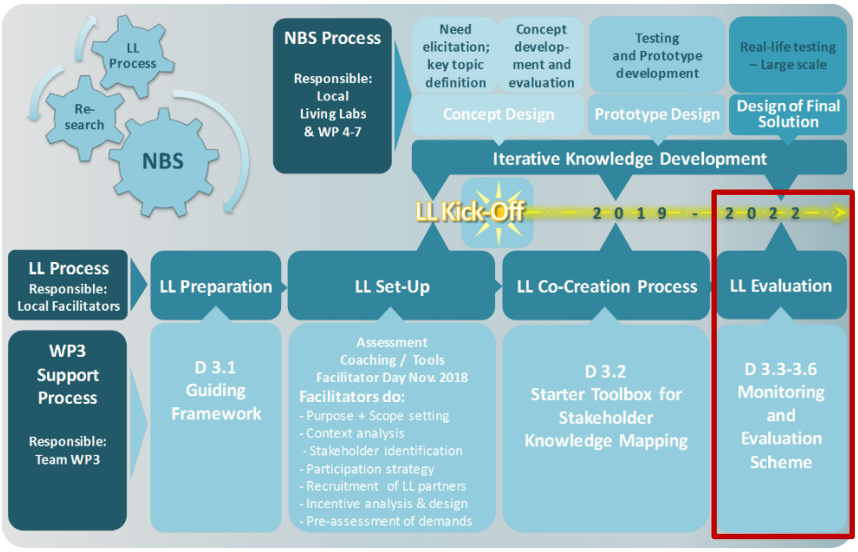

Figure 1. Overview to the PHUSICOS Living Lab process in its contextual embedding of NBS development (top), Local facilitators' tasks (middle and below) and WP3 support services (below). D3.3, D3.4 and D3.6 are intended to support the quality management of the Living Lab Co-Creation Process, here highlighted by a red framework. (Graph from: Fohlmeister et al. 2018, Design: C. Smida).

Within the overall context of PHUSICOS, D3.6 and its predecessors together with deliverables such as the D4.1 (Comprehensive Framework for NBS Assessment) form the building blocks of a multi-level approach for M&E (see Fig. 2):

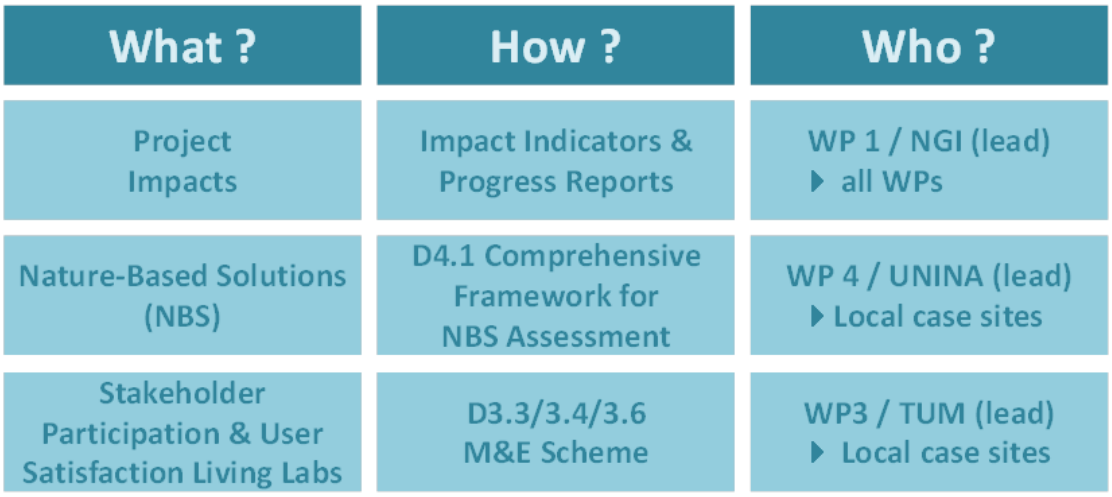

Figure 2. M&E in PHUSICOS is taking place for the project itself as well as within specific WPs for the case study sites: D3.3 is the M&E building block that focuses on assessing stakeholder participation and user satisfaction with the Living Lab experience. Design: S. Fohlmeister & C. Smida 2019.

As Figure 2 illustrates, M&E is practiced for various purposes. On the one hand, the achievement of the project's overall goal is regularly assessed on behalf of Work Package 1 (WP1), making use of impact indicators and progress reporting. On the other hand, M&E is important for assessing the core products of PHUSICOS, the Nature-Based Solutions (NBSs). For example, Work Package 4 (WP4) provides an important tool for this purpose, D4.1 *Comprehensive Framework for NBS Assessment*.

M&E also plays a key role in measuring and steering stakeholder participation and user satisfaction with the Living Lab processes at the local case study sites. The *Monitoring & Evaluation Scheme* aims to provide a useful instrument both for and together with the case study sites and Work Package 3 (WP3). It shall help to keep the Living Lab processes on track to detect potential bottlenecks and room for improvement, gain valuable insights concerning the Living Labs' advancement and to achieve stakeholder support and their feeling of ownership for the co-designed NBSs at the local level.

Titled as *Version 3*, the M&E scheme in D3.6 represents the follow up on Deliverable Reports D3.3 and D.4 and an iterative process together with site owners and facilitators, WP1 and WP2. It incorporates evolutions made responding to the expressed needs and further development of M&E materials reflecting the different Living Lab processes.

1.2 Outline of this deliverable

The report aims to address especially four groups in their work on NBSs:

- the facilitators of the PHUSICOS Living Labs who will steer and manage the stakeholder involvement processes at the demonstrator and concept case sites;
- local scientific and end-user partners as well as other Living Lab participants of the case study sites who will select, co-design and evaluate the NBSs;
- PHUSICOS project partners, such as Work Package (WP) leaders and their collaborating teams, to achieve a coherent understanding and implementation of key concepts; and finally
- a broader audience such as planning practitioners, politicians and scientists working on co-designing NBSs for climate change adaptation, land use planning, disaster risk management, and related fields, and wishing to employ Living Lab approaches to find innovative ways of developing and implementing solutions inspired by nature.

D3.4 has two parts (**A and B**), consisting of a total of eight chapters. This division shall satisfy the expectations of both the interested as well as the quick reader of this report. While Part A offers a thorough introduction into the field of M&E, a quick access to Part B is possible for those target groups who wish to get to know the M&E scheme directly, and seek for related information to its design and application.

The present chapter shortly describes the background of this deliverable and provides an introduction to its purpose and outline.

Chapter 2 is dedicated to the methodology of how this deliverable was developed.

PART A, comprising Chapters 3 to 5, presents the theoretical background considerations to the M&E scheme.

Chapter 3 introduces the *Why of M&E* to the reader by making explicit its importance for effective stakeholder participation, and by shedding light on the two letters in "M&E", defining the connected key terms.

Chapter 4 highlights the *How of M&E*, guiding the reader through principle key steps of designing and operationalizing an M&E system in a project.

Following this, Chapter 5 offers some insight into contemporary practice of M&E related to participatory processes. Here, the reader has the opportunity to learn about indicator-based M&E, and to get to know common data collection methods as well as display options related to M&E findings. Furthermore, typical M&E challenges are presented and possible ways to overcome them shown.

Based on these theoretical background considerations, **PART B** focuses on the M&E scheme that is at the core this deliverable.

In a first step, Chapter 6 approaches the M&E scheme by presenting a comprehensive pool of evaluation criteria that reflects contemporary practice to assess stakeholder participation from contexts similar to PHUSICOS. Resulting from a thorough literature analysis, this pool offers a sound orientation to the case study sites on what means a good standard of stakeholder participation, and what matters to go beyond it in the sense of an innovative Living Lab experience being targeted in PHUSICOS.

In a second step, Chapter 7 proceeds with operationalizing the M&E scheme for PUSICOS based on the evaluation criteria presented in Chapter 6. This process is guided by a 'Result Chain' derived from targets and milestones formulated in the Document of Action (DoA) for the PHUSICOS Living Labs. The set of indicators is provided along with guidance on the frequency of M&E, data collection methods and responsibilities. The chapter then describes the first steps that have been taken for the operationalization of the M&E scheme and its application to evaluate the Living Lab processes as well as to capture and leverage stakeholder knowledge. Chapter 8 presents final remarks and reflects uncertainties related to the SARS-CoV-2 outbreak and strategies to adapt.

2 Methodology

The methodology applied for preparing deliverable D3.3 and its follow up versions D3.4 and D3.6 was a stepwise procedure building on knowledge from both science and practice in order to design an M&E scheme being of best possible use to the intended target groups of this report (see Chap. 1.2).

The point of departure for the research undertaken was the following set of research questions:

- What is M&E and how to establish an M&E system in a project?
- What is contemporary practice of M&E related to stakeholder participation processes in contexts being similar to PHUSICOS?
- Which key elements should an M&E system consider to successfully monitor and evaluate stakeholder participation and user satisfaction with Living Lab procedures within PHUSICOS?

In order to address these questions, a thorough literature review and analysis of both scientific and grey literature was conducted. The scientific literature analysis focused on three different source pools (Scopus, Web of Science (WoS) and Google Scholar) and articles were acquired by systematic search for selected keywords (see Table 1). Additionally, publications by the European Network of Living Labs (ENoLL) were taken into account.

Appropriate articles were supplemented by grey literature, thereby project reports and M&E guidelines proved especially useful. Grey literature was acquired by internet search using the terms presented in Table 1. Thus, it was aimed to identify publications relevant for the context of PHUSICOS. As the study unfolded, the literature base was supplemented by using a mix of snowballing and expert consultation.

The applied search strategy did not only focus on terminology concerning Living Labs and NBSs, but also the related fields of climate change adaptation, disaster risk management, land use management, landscape planning, flood risk management and action research. This was based on the consideration of M&E being a cross-sectoral topic, and for detecting insights relevant to PHUSICOS.

Combining terms of all four columns yielded no results. Therefore, terms related to rural areas were dropped. Likewise, the combination of key terms within the remaining three columns did not lead to satisfactory results. Consequently, M&E terms were used together with related terms from the Living Lab column and NBS column.
After an initial search this set was supplemented by the terms *learning lab* (column 3), *environmental decision-making* and *natural resource management* (column 4). Moreover, the German translations were used, which proved especially useful for grey literature.

Table 1. Key terms of the literature review employed for D3.3.

Main Search Terms	Monitoring, Evaluation	Living Lab	Nature-based Solutions	Rural areas
Related Terms	M&E	Real Lab	Climate change adaptation and management	Rural Living Labs
	Demand assessment	Stakeholder involvement	Disaster risk management	
	Quality management / control	Participation	Land use management	
	Effectiveness	User driven innovation	Landscape planning	
	User satisfaction	Public decision making	Flood risk management	
		Participatory environmental governance	Action research	

In this way, a similar number of both scientific and grey literature sources were collected (135/140). Almost a third of the encountered sources focused on general M&E. This literature string was primarily used to establish a broad knowledge base for assembling the theoretical background considerations on M&E. Thereby, grey literature originated from international organisations' work mainly.

Next to this general M&E literature, a second string of information was required to be able to gain insights within PHUSICOS-related contexts. Therefore, literature on participation, NBSs and Living Labs was consulted to identify best practices, potential pitfalls and other insights being transferable to M&E of stakeholder engagement. Moreover, the search focused on literature about M&E of NBSs and Living Labs in general as well as regarding stakeholder and public participation. This second part of the literature analysis was also used to compile the pool of evaluation criteria (see Chap. 6.2)[1] that formed the point of departure to deduce evaluation criteria and indicators for the M&E scheme of PHUSICOS. Both scientific and grey literature sources were relevant to this step.

Remaining knowledge gaps were filled by the acquisition of additional sources stemming from International Project Management practice, and experience-based consultation on specific items, such as the Result Chain approach employed for deducing the final M&E scheme for PHUSICOS.

[1] For a detailed description of the investigated technical fields and procedure to assemble the pool of evaluation criteria, see Chap. 6.1 *Introductory remarks to Pool of Criteria*.

PART A:

BACKGROUND CONSIDERATIONS TO THE M&E SCHEME

3 The "Why" of M&E: a justification

3.1 Why does effective stakeholder participation matter – and how to ensure it?

Engaging stakeholders in decision-making processes is considered increasingly important and also mirrored in EU policies. On this level, participatory approaches are required by the Aarhus convention (European Commission, 1998) and included in the Water Framework and Floods Directive (Newig and Koontz, 2013).

Participation is also relevant in relation to NBSs. One of the criteria mentioned in the IUCN's current draft standard for the establishment of NBSs is that "NbS are transparent and stakeholder-inclusive throughout their lifecycle" (IUCN, 2019, p. 11). Here, it is asserted that stakeholders' insights and activities are crucial to ensure the success of NBSs. Thus, their perspectives should be incorporated into planning, design and implementation thereof (IUCN, 2019).

To ensure a sound participatory process in the development of NBSs is thus a key component which deserves careful attention. On what is to be understood by *effective* stakeholder participation, authors in the scientific literature seem rather united by mentioning a variety of characteristics, such as transparency, representativeness, good facilitation, early and continuous involvement as well as learning and the power of participants to influence (e.g., Eckart et al., 2018 and see Chap. 6.2).

Similarly, reasons are well-known and frequently listed when it comes to explain why effective stakeholder participation matters. Among them, a higher quality of decision-making and project implementation as well as increased legitimacy prominently are mentioned in literature (Newig, 2007). Additional benefits to be generated are an increase in trust, an improved understanding by the participants, the consideration of diverse perspectives and thus the potential to achieve a higher quality of a project's intervention, the acceptance thereof as well as social learning (Luyet et al., 2012). Regarding NBSs, participation is valued as being important, as it "can ensure co-design, innovation, ownership and later stewardship of NBS […]. Finally, stakeholder engagement is also relevant for sharing of knowledge and learning across and between cases" (Nesshöver et al., 2017, p. 1222).

In contrast to this obvious clarity regarding the importance and justification of effective stakeholder participation, the way of *how* to best realizing and ensuring it seems comparably opaque.

Being an innovation action project, the Living Lab approach within PHUSICOS intends to involve stakeholders beyond information and consultation levels required by law: "Living Lab participants are enabled to build up ownership for the innovative solution they are heading for, accompanying the NBS step by step through its stages, and may have a word in its selection; co-design; implementation and performance evaluation" (Fohlmeister et al., 2018, p. 46).

That said, a close and continued observation of the stakeholder involvement processes at the project's case sites will be key to make sure this target is achieved. The design of a suitable M&E scheme plays a key role on this background, as it can help to detect voids and prevent undesired developments from an early point of time, thus being a relevant contribution to successfully steer stakeholder participation towards its intended results.

3.2 What is M&E?

Before illustrating how an M&E system can be designed and operationalized, it is important to clarify what is understood by the widely-used terms *monitoring* and *evaluation* (M&E[2]).

"**Monitoring** can be defined as a continuing function that aims primarily to provide the management and main stakeholders of an ongoing intervention with early indications of progress, or lack thereof, in the achievement of results. An ongoing intervention might be a project, program or other kind of support to an outcome" (Sera and Beaudry, 2007, p. 1). Thus, a monitoring system provides routinely and continuously data about a project (Larson and Williams, 2009; Muller-Praefcke et al., 2010; Waite et al., 2011) and compares its state against the operational plan by answering the question "*Are we doing the things right*?" (Grunwald et al., 2011, p. 28). This includes the assessment of activities, resource use, targets as well as unexpected changes (Grunwald et al., 2011). Thereby, monitoring helps to identify developments (Stockmann, 2004) as early as possible (SOAS, 2013). This data on the performance within a project (Waite et al., 2011) is usually passed on to decision-makers in time to assist them in project management. Thus, the project's manager and the involved staff (Waite et al., 2011) can "deal with problems, improve performance, build on successes and adapt to changing circumstances" (European Commission, 2004, p. 100).

Evaluation is complementary to monitoring (SOAS, 2013). The OECD defines it as "[t]he systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation and results. The aim is to determine the relevance and fulfilment of objectives, development efficiency, effectiveness, impact and sustainability" (Working Party on Aid Evaluation, 2002, pp. 21–22). Thus, evaluation provides the answer to the question "*Are we doing the right things?*" (Grunwald et al., 2011, p. 28). Thereby, both systems complement each other.

Monitoring provides data on the state of a project (UNDP, 2009), allows for remedial action (European Commission, 2004) and answers the question whether a project is implemented the way it was planned (Grunwald et al., 2011). Building on that, evaluation is based on monitoring data and assesses its concept, design, implementation as well as outcomes. The overall objective of the project serves as a basis for this analysis (Grunwald et al., 2011). In this way, a learning process is enabled (Singh et al., 2017).

[2] Due to the close connection and interrelation between the two terms, they will be used mostly together in this deliverable, and be abbreviated by M&E for practical reasons.

The insights gained are relevant to planners and policy makers (European Commission, 2004) as well as staff involved in project management and stakeholders (Waite et al., 2011).

Evaluation takes place less frequently than monitoring and is performed at key points before, during or after a project (Waite et al., 2011). A common distinction is made between summative and formative approaches to evaluation. Summative evaluation is result-oriented (Hoffmann et al., 2009) focusing on outcomes and impacts (ESF, 2014). Thereby new insights are generated which enable decision-making (Beywl, 2008). On the other hand, formative evaluation accompanies the process and thus enables adaptations during the project (Hoffmann et al., 2009). It can be used to improve the project design and implementation (ESF, 2014) as well as its use (Beywl, 2008).

While monitoring is usually performed by the people responsible for the implementation of a project, evaluation can be done internally or externally (Hitchcock, 2014) (see Table 2).

Table 2. Monitoring and Evaluation – two complementary sides of the same medal.

	Monitoring	Evaluation
Key Question	"Are we doing things right?" (Grunwald et al., 2011, p. 28)	"Are we doing the right things?" (Grunwald et al., 2011, p. 28)
Purpose	Identification of developments of the ongoing project (Stockmann, 2004), enabling remedial action (European Commission, 2004)	Assessment of an ongoing or completed project regarding its concept, design, implementation and outcomes (Grunwald et al., 2011)
Aim	Provision of data as an overview about the project development and as a basis for decisions (European Commission, 2004) and evaluation (UNDP, 2009)	Learning (Singh et al., 2017), provision of recommendations (Waite et al., 2011), basis for management decisions (Muller-Praefcke et al., 2010)
Procedure	Tracking of activities and resource use, achievement of targets, unexpected change (Grunwald et al., 2011)	Assessment of monitoring data (UNDP, 2009)
Reference	Operational plan (Grunwald et al., 2011)	Overall objective of the project (Grunwald et al., 2011)
Results	Descriptive (Hughes and Niewenhuis, 2005), "project performance data" (Waite et al., 2011, p. 27)	Interpretive (Hughes and Niewenhuis, 2005), "strategic findings and recommendations" (Waite et al., 2011, p. 27)
Frequency	Continuously (Waite et al., 2011)	Certain points of time
Responsibility	People responsible for the implementation of a project (Hitchcock, 2014)	Internal or external assessors (Hitchcock, 2014)
Addressees	Staff, project manager (Waite et al., 2011)	Planners, policy makers, donors (European Commission, 2004), staff, stakeholders (Waite et al., 2011)

The general importance of M&E is highlighted by the Project Cycle Management (PCM) approach adopted by the European Commission in 1992 and updated in 2003. It includes the stages programming, identification, formulation, implementation as well as evaluation & audit (European Commission, 2004). Monitoring takes place during the implementation step within PCM. In this approach, each stage serves as the basis for the next step (Spreckley, 2006). Therefore, M&E is an integral part of the European Union's Project Cycle Management and acknowledged as key tool to track and steer a project's implementation towards its intended goals.

3.3 Aims and possible benefits of M&E

As previously stated, M&E fulfils a key function in a project, and can be considered beneficial for a diversity of reasons. Often, the advantages are closely interrelated (Stockmann, 2004). The literature review conducted for this deliverable contributed to identify three main levels on which these benefits can occur: the normative, project and society level.

Normative level

M&E provides a transparent overview about the use of resources as well as the outcomes achieved and can thus support the justification of a project to different stakeholders (Austrian Development Agency, 2008). Thus, M&E improves the accountability of a project (Hughes and Niewenhuis, 2005).

Transferred to the context of NBS research projects, M&E can contribute to foster evidence and bring forward important insight for future project design. Regarding M&E related to stakeholder participation, insights into the quality of participation and how it can be ensured are especially meaningful (Nabatchi, 2012).

Project level

M&E is an important steering tool of project management, and as such helps to identify problems and success factors early on (Gühnemann, 2016). The insights gained serve as a basis for decision-making (Frankel and Gage, 2007). Ideally they make a project or process design more efficient in the long run as they reduce the potential for repetitive mistakes (Hughes and Niewenhuis, 2005). Recommendations can be deduced (Grunwald et al., 2011) and resource allocation as well as communication can be improved (Gühnemann, 2016). Continuous learning (Hoffmann et al., 2009; Nabatchi, 2012) as well as the general increase of knowledge and understanding via an M&E framework further enhance the process (Blackstock et al., 2007). Thus, current as well as future projects can be improved (Austrian Development Agency, 2008).

Transferred to the M&E of participatory processes, additional benefits can be identified. Establishing an M&E system can assess and improve the suitability of participatory methods (UNESCO, 2009; Luyet et al., 2012), as well as foster representativeness (Rowe and Frewer, 2004) and ownership (UNESCO, 2009). Ownership for a project intervention might even be further increased depending on the level of stakeholder interaction with regard to the M&E system (Estrella et al., 2000). For example, stakeholders might have an active part in the choice of evaluation criteria (Stockmann, 2004), data acquisition or design of corrective action (Vaughn, 2018).

Society level

The performing agents of an M&E system, ranging from the project management team to all stakeholders involved, benefit due to the learning effect during the M&E process (Kusek and Rist, 2004). The knowledge gained in an M&E process on the effects of different process elements (Kusek and Rist, 2004) as well as their success (Hughes and Niewenhuis, 2005) can be used in further research to increase the understanding about this topic.

Transferred to M&E of participatory processes, the society benefits by gaining insights and awareness about the needs, priorities, perceptions and satisfaction of stakeholders (UNESCO, 2009). Thus, the project can be adapted accordingly.

While advantages of M&E are widely discussed within the scientific literature, disadvantages are mentioned less frequently, and then among practitioners mainly. For example, the Deutsche Welthungerhilfe lists common prejudices regarding monitoring. It argues that monitoring might be perceived as an additional burden which hinders the execution of other important activities by gathering data which is not used in the end. Moreover, it might be perceived as complex and something which has to be performed for donors only (Paulus, 2008a). Furthermore, the combination of M&E can be perceived as “difficult and daunting” (Garbutt, 2013, p. 2).

With regard to M&E of participatory processes, Rosener (1981) is among the few critical authors dealing with possible bottlenecks (Chess and Purcell, 1999; Nabatchi, 2012). According to her “the participation concept is complex and value laden; […] there are no widely held criteria for judging success and failure; […] there are no agreed-upon evaluation methods; and […] there are few reliable measurement tools” (Rosener, 1981, p. 583).

Despite potential prejudices and challenges (see also Chap. 5.3), an M&E system is essential to track a project intervention’s advancement towards its targets, as well as to detect undesired developments and discover room for further improvement. Likewise, success factors can be identified and valuable lessons learned for both the ongoing and future project interventions.

4 The "How" of M&E: key steps to design and operationalize an M&E system

The M&E system of a project can be designed in many ways depending on its contextual factors and demands and thus has to be developed based on the individual project. However, there are some key steps for establishing an M&E system that can be considered a general guidance.

There are several approaches to formulate the key steps of building up and applying a project's M&E system. These concepts originate from different backgrounds ranging from general M&E guidelines (Beywl, 2008; Nabatchi, 2012) to thematic fields such as sustainable mobility (Gühnemann, 2016), rural development (Steiner et al., 2000; Guijt and Woodhill, 2002), community work in general (Kurz and Kubek, 2017) as well as in international development cooperation (Paulus, 2008a). While they all differ in details, common steps are identifiable (see Fig. 3):

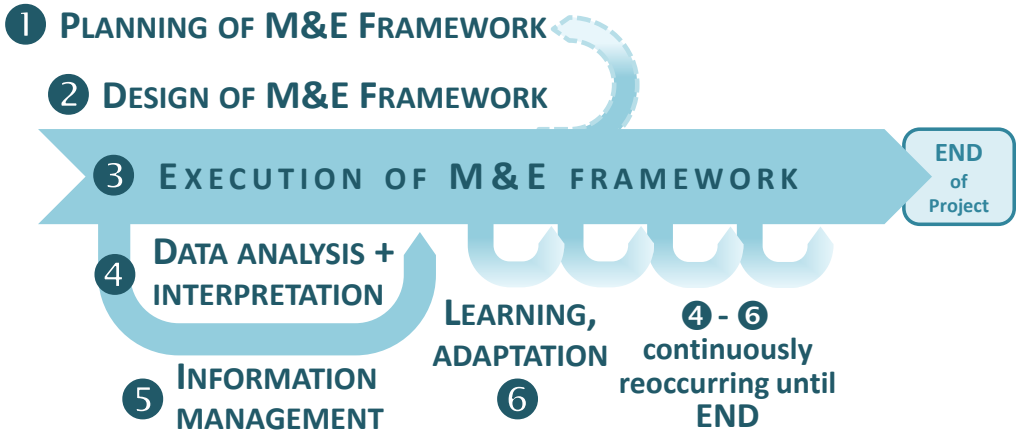

Figure 3. Key steps of designing, establishing and using an M&E system.
Design: M. Tiebel & C. Smida 2019.

In a first step the general framework of the intended M&E system needs to be planned and clarified, including defining its purpose, contextual setting and the degree of intended stakeholder involvement (see Chap. 4.1). Afterwards, the M&E system is designed in more detail and operationalized (see Chap. 4.2). Ideally, the M&E system is functioning and executed in the third step (see Chap. 4.3) which lasts until the end of the project (Kusek and Rist, 2004). It delivers information serving as a basis for data analysis and interpretation (see Chap. 4.4 and 4.5) and thus supports the evaluation taking place at pre-defined points of time. Information and insights gained have to be communicated. Finally, learning can take place, and adaptation as needed (see Chap. 4.6). Ideally the first two steps do not have to be repeated. However, if the M&E process dictates the necessity of changes, an adaptation has to take place. This is illustrated via the dotted arrow. Kusek and Risk (2004) argue that such a step-by-step system is useful, but that the order is not fixed as some steps might need to be repeated while others happen at the same time. Therefore, an M&E system requires some flexibility and feedback loops as illustrated by the faded arrows in Figure 3.

4.1 Planning the M&E system

Before the M&E system can be designed in detail, it is important to clarify some basic parameters (Nabatchi, 2012). These are, above all, the purpose, priorities and aims, scope, and intended stakeholder involvement. A document describing these parameters is useful and ideally functions as a living document as it should be adapted to new developments if needed (Gühnemann, 2016).

Purpose

Specifying the reasons or need to monitor and evaluate is important in order to focus the framework and to avoid gathering unnecessary data (IFRC, 2011). Common purposes are to steer the project efficiently towards its intended results and according to ongoing developments made transparent by the M&E system (see Chap. 3.3), to make fundamental decisions regarding the project as well as to provide information to enrich public, political or scientific discussions (Beywl, 2008).

Aims

After having clarified the purpose of establishing an M&E system, its aims need to be defined. An aim can be a desired outcome to be achieved by the project or a state to be reached in the future. Thereby aims can have different forms, as for example expressed in different values of an indicator, depending on the point of time (Gohl, 2002; see also Chap. 5.1 and 7.2). They should be connected to the general purpose of the project (Nabatchi, 2012). For Gohl (2002), a common mistake in defining aims is that activities are listed instead of the desired effects. For example, instead of describing the desired outcome of enabling learning within a project, the activity to invite a certain number of experts or to conduct a certain type of trainings could be stated.

Scope

Another decisive factor when setting up an M&E system is to define the scope it shall have. This decision is directly linked to the available temporal and personal resources as well as to the data availability and potential additional factors (Nabatchi, 2012). The M&E capacity has to be assessed to be able to choose an approach and those methods that best fit to the resources, ideally while meeting the desired aims (Vaughn, 2018). Importantly, it has to be ensured that an M&E system can be designed, performed and its insights be used within the given time frame. As a rough estimate, M&E can cost between three and ten percent of the total budget (Kurz and Kubek, 2017).

Stakeholder involvement

Ideally, the degree of stakeholder involvement related to the M&E system is defined early in the process to be able to include different stakeholders when developing M&E aims or evaluation criteria (Sera and Beaudry, 2007). A stakeholder analysis can be necessary to identify potential participants, their interests and skills (Beywl, 2008; Biancalani et al., 2004). In general, it has to be determined who will participate at what stage of the M&E process such as during its design, the implementation and/or reporting.

In practice, a distinction is made here between *conventional* and *participatory* approaches to M&E (Estrella et al., 2000). While **conventional** M&E approaches involve stakeholders as resource persons in the framework of data acquisition only, **participatory** M&E (pM&E) highlights stakeholder involvement to a bigger extent, ranging from the formulation of indicators to data collection and analysis (Larson and Williams, 2009).

There are several reasons why it can be useful to integrate stakeholders in the design or performance of an M&E system. The validity of the framework can be increased by considering different interests, values and needs (Stockmann, 2004). As participants are directly affected by the participatory process, they can also provide additional insights. Furthermore, pM&E can be seen as a learning process which strengthens stakeholders' capacities (Estrella et al., 2000). Another benefit might be a higher acceptance of project interventions, as well as a better understanding and motivation amongst participants (Kurz and Kubek, 2017) which is especially important as M&E is dependent on cooperation and support (Stockmann, 2004). Moreover, resources can be saved in the process of data collection (IFRC, 2011). However, there are also some drawbacks to pM&E. Participants might not have sufficient knowledge (Gohl, 2002) and the process can be cost and time intensive (Waite et al., 2011). Furthermore, participants might not be able to carry out this responsibility continuously and not be willing to share information which are of personal disadvantage (Gohl, 2002). The support by qualified facilitators is useful to guarantee a functioning process in which all participating groups can have equal power (IFRC, 2011). Otherwise, data collection and decisions can be dominated by more powerful groups (Waite et al., 2011).

The chosen degree of stakeholder participation in the design and execution of an M&E system thus depends on the project (IFRC, 2011). An intensive participation is not always possible (Dyer et al., 2014). Moreover, the involvement of few representatives of certain groups might result in a more efficient process than involving as many participants as possible (Blahna and Yonts-Shepard, 1989).

Data demands

After having planned the general outline of the M&E system, it has to be determined what kind of information is needed (Beywl, 2008). Oberndörfer et al. (2010) recommend combining quantitative and qualitative data. Quantitative data originates from surveys, reports, tests and other sources and requires statistical knowledge (Vaughn, 2018). It can be helpful to analyse cost-benefit-relations (Blackstock et al., 2007) and also for executing comparisons (Kurz and Kubek, 2017). Although often considered as more objective and less biased, quantitative data is not as useful as qualitative data to allow for conclusions regarding the causes of certain developments (IFRC, 2011). The latter one can provide a deeper understanding of stakeholders' perceptions (Blackstock et al., 2007), and thus be important for identifying causal relationships (Kurz and Kubek, 2017). Suitable instruments gather narrative data from interviews, stories and other sources (Blackstock et al., 2007). For both data types the amount of information gathered needs to be kept manageable (Grunwald et al., 2011).

Context of the project

Further to the analysis of data demands, it is important to consider the context in which the M&E of a project is situated (Beywl, 2008; Abelson and Gauvin, 2006). Context means "the environment in which an exercise takes place, including the political/cultural/economic climate […] as well as the nature of the issue being considered" (Rowe and Frewer, 2004, p. 548). Monitoring and evaluating this very context is meaningful to identify emerging risks as well as to review assumptions (European Commission, 2004). Therefore it is essential to also consider contextual factors in the design and operationalization of an M&E-system (Faehnle and Tyrväinen, 2013).
An analysis of the context ideally takes place before starting a project, during its performance and when data indicates that the contextual developments might negatively influence the project (Kurz and Kubek, 2017). Identifying key contextual variables and defining influencing factors will allow the comparison of results across different projects (Rowe and Frewer, 2004). Moreover, these variables can document the progress of a project (Appel, 2002) and if known beforehand can be considered and thus improve the process. After identification, information about these contextual variables needs to be obtained (Kurz and Kubek, 2017).

4.2 Designing the M&E system

Once the conditions of the M&E system have been clarified, the next step is to plan its implementation. Essentials of this design are the formulation of M&E activities as well as a clear distribution of roles and responsibilities.

Determination of M&E activities

An M&E plan (for an example, see Appendix A) is a helpful tool to identify all essential parts of the M&E process as well as to assess its operationalization. The parameters which need to be defined are the expected project targets, indicators[3], related data collection frequency and methods, persons being in charge as well as the intended data use (Paulus, 2008b; IFRC, 2011). The formulation of targets guarantees a certain degree of unbiasedness as expectations will be stated clearly and the outcome will not be glossed over (Hoffmann et al., 2009).
When determining the required activities, triangulation is recommended. This approach combines different methods and thus increases the reliability of results (IFRC, 2011). The amount and type of M&E activities strongly interrelate with the available resources. If only very limited resources are available, the M&E activities and corresponding methods of data acquisition and analysis need to be adapted to this condition. For an overview to potential data collection methods, see Chapter 5.2 and Appendix B.

[3] If such an approach was chosen, see also Chapter 5.1 *Indicator-based M&E*.

Responsibilities

Furthermore, the responsibilities within the M&E process need to be defined (Nabatchi, 2012). A common distinction is made between *internal* and *external* M&E (see Table 3). **Internal M&E** is performed when the executing persons are working for the organization responsible for the project (Stockmann, 2004). This system has several advantages as the involved project partners are already familiar with each other (Appel, 2002), and tend to have a higher degree of expertise in the topic of concern as well as in the project context (Kurz and Kubek, 2017). Thus, the responsible M&E staff can rely on first-hand information (Arbter, 2011). Due to the immediate contact it can often be performed faster, without additional communication loops with a third party, so that recommendations can be considered more immediate (Stockmann, 2004). On the other hand, the responsible staff might lack experience and methodological knowledge, distance and unbiasedness (Stockmann, 2004; Kurz and Kubek, 2017). Thus, negative results might not be communicated transparently (Arbter, 2011).

The disadvantages of an internal M&E are likewise the advantages of an **external M&E**. An external institution being specialized on M&E is independent (Stockmann, 2004), objective (Nabatchi, 2012) and can offer methodological expertise. Recommendations from external organizations often have a higher degree of legitimacy and thus might have a stronger influence (Stockmann, 2004). The distance to the project enables new perspectives (Arbter, 2011) and negative results will probably be communicated more openly (Blackstock et al., 2007). While Kurz and Kubek (2017) argue that recommendations made by external M&E experts are more likely to be accepted by stakeholders, Kirchner-Heßler et al. (2007) point out that participants might react defensively as they see the external person as someone who assesses and judges them. Moreover, such an external M&E approach might result in higher costs (Stockmann, 2004).

Table 3. Internal versus external M&E: a comparison.

	Advantages	Disadvantages
Internal M&E	• Familiarity between project partners • Use of first-hand information • Expertise in the topic / project • No communication to a third party • Learning effect • Immediate consideration of recommendations • Lower cost	• Lack of methodological knowledge / experience • Lack of resources • Lack of distance • Potentially biased • Unwanted results might not be communicated
External M&E	• High degree of methodological knowledge / experience • Independence / objectivity • New perspectives • Higher degree of legitimacy, stronger influence, higher acceptance	• M&E perceived as “external control” • Higher cost • Additional communication to third party • Lack of insider knowledge • Use of second-hand information • Less learning effect within the project

A compromise between internal and external M&E can be a combination of both approaches. An example of such an approach is to separate responsibilities regarding the preparation and performance of an M&E method and its interpretation (Kirchner-Heßler et al., 2007). In the case of a highly complex M&E system it might be advisable to have additional resources and expertise on board. Feedback-talks, technical backstopping or mediation in situations of conflict could be outsourced if deemed appropriate (Hoffmann et al., 2009).

Whoever performs the M&E should be trustworthy and unbiased. Methodological and technical competencies are needed to achieve a high degree of trust and acceptance of the results (Beywl, 2008). The person responsible should possess social skills, be open-minded to different perspectives and be able to achieve a constructive working atmosphere. Moreover, flexibility is meaningful (Richards et al., 2007).

Specification of data use

The activities determined at the beginning of this step produce data. Thus the establishment of a system which clearly defines data handling is important. Seven key parameters have to be considered and discussed before collecting data: data format, data organization, data availability, data security and legalities, use of information technology, data quality control as well as responsibility and accountability of data management (IFRC, 2011).

Frequency

The frequency of execution differs between monitoring and evaluation. Monitoring is conducted regularly and continuously (Muller-Praefcke et al., 2010), and can thus have different frequencies, such as weekly, monthly, quarterly, bi-annually or likewise. Evaluation is performed in a less frequent manner and at specific points of time (Waite et al., 2011):

Ex-ante: This kind of evaluation is conducted prior to the implementation of a project (UNDP, 2009; ESF, 2014). It aims at influencing the project's strategy (Hoffmann et al., 2009) as well as assessing future effects (UNDP, 2009).

In itinere: This evaluation approach takes place during the implementation of a project, and thus allows for its adaptive management (ESF, 2014). Evaluation is conducted after key steps have been accomplished or when there are concerns such as a big difference between planned and actual progress (Kusek and Rist, 2004). A special case is the real-time evaluation which can be defined as a "real time analysis of progress against higher-level objectives" (Waite et al., 2011, p. 25).

Mid-term evaluation: This evaluation is of formative nature and performed, as the name tells, in midst of a project's course. Here, the performance mid-way is compared to targets, contextual factors analysed for changes and elaborated whether a change of plan is required (Waite et al., 2011). In this manner, the project's performance can be improved prior to its completion (UNDP, 2009).

Terminal evaluation: A terminal, final or end-of-project evaluation (Waite et al., 2011) is done after the project is completed (Hoffmann et al., 2009). It is a summative form of evaluation (UNDP, 2009; Waite et al., 2011) and aims at gaining knowledge about success factors as well as about the achievement of aims (Hoffmann et al., 2009). It is often performed externally (Waite et al., 2011). The gained insights are used for future planning of similar project interventions (Hoffmann et al., 2009).

Ex-post: This evaluation is also called impact evaluation and takes place some time after the project's completion (Waite et al., 2011). Thus, this approach is of summative nature (UNDP, 2009) and success factors, the achievement of objectives (Hoffmann et al., 2009), long term changes (Waite et al., 2011) as well as the sustainability of outcomes in the centre of interest. Conclusions can especially be drawn for future project designs (UNDP, 2009).

4.3 Executing the M&E system

In this step the monitoring of the project and thus data collection begins. Data should be of high quality, reliable and valid (Nabatchi, 2012). This step is not about collecting as much data as possible, but the most relevant information, which helps in the management of the process (Grunwald et al., 2011). The formulation of data collection guidelines as well as a pre-test of selected instruments can be helpful (IFRC, 2011).

Collecting baseline data is especially important for being able to judge developments which take place during the course of the project (Gohl, 2002). The extent of such data collection is controversial. Oberndörfer et al. (2010) argue that baseline data needs to be broad as it is unknown at this state of the process what kind of information might prove useful in the future. However, Kusek and Rist (2004) recommend to use the first measurements of the indicators as a baseline and not to collect additional data.

Standardized approaches can support the M&E system. One example is the Logical Framework Approach (LFA). This technique "provide[s] a structure which will allow project planners and evaluators to specify the components of their activities and identify the logical linkages between a set of means and a set of ends" (Coleman, 1987, p. 252). The LFA, developed in the 1960s by the US Agency of International Development (USAID) (Coleman, 1987) and a standard component of Project Cycle Management demanded by the European Commission since 1993 (European Commission, 2004), is making use of a matrix – the Logical Framework Matrix (*Logframe* or *LFM*) to summarize a project's intervention strategy at a glance (Waite et al., 2011). As illustrated in Table 4, the LFM shows a vertical hierarchy of objectives (Crawford and Bryce, 2003): activities contribute to results which aim to fulfil a certain purpose and thus contribute to an overall objective. The columns illustrate the way in which each element is going to be assessed based on cause-effect relationships (Lamhauge et al., 2012).

Table 4. Logical Framework Matrix (based on European Commission, 2004).

Hierarchy of objectives	Performance indicators	Data sources	Assumptions and risks
Overall objective: Longer-term project impact	Measurable indicators for overall objective	Data sources for verifying status of overall objective-level indicators	Assumptions/risks between goal and overall goal
Purpose: Near-term project impact. The essential motivation for undertaking the project	Measurable indicators for end-of-project impact	Data sources for verifying status of purpose-level indicators	Assumptions/risks between purpose and overall objective
Results: The deliverable(s) of the project	Measurable indicators for results	Data sources for verifying status of result-level indicators	Assumptions/risks between results and purpose
Activities: Smaller work packages needed to accomplish each result	Budget summary	Data sources for verifying status of budget and activities	Assumptions/risks between activities and results

The framework can be used to develop detailed activities of an M&E system by providing a consistent structure. While monitoring assesses the resources, activities and results, evaluation is responsible to track especially the purpose as well as the overall objective (European Commission, 2004). By carefully following this technique, a comprehensive understanding about the content and aims of a project can be developed and thus, a suitable M&E framework planned and executed.

4.4 Data analysis and interpretation

Following the start of the monitoring process and the generation of data, data analysis and interpretation need to be performed and subsequently conclusions will be drawn (Appel, 2002). Thereby, "[d]ata analysis is the process of converting collected (raw) data into usable information" (IFRC, 2011, p. 48). Trends, clusters and relationships within the data are identified with the aim to detect problems early-on, to develop solutions and conclusions (IFRC, 2011).
Firstly, the data needs to be processed which means systematized and summarized. This can be accomplished by entering data in a statistical program or by formulating core statements. Afterwards the data has to be checked systematically for plausibility. A joint reflection on the results by the stakeholders can be useful (Kirchner-Heßler et al., 2007; Hoffmann et al., 2009; Oberndörfer et al., 2010) to find out whether the data match their experiences (Kurz and Kubek, 2017). In the next step, the data is analysed, reflected and interpreted to assess if the project is developing as planned (Kurz and Kubek, 2017). Ideally, data analysis is performed as soon as possible after collection in order to be able to use the insights for project management and reporting (Kurz and Kubek, 2017).

A variety of data analysis methods exist ranging from descriptive to statistical approaches (Nabatchi, 2012). The choice of a suitable method depends on the kind of data that is collected. Quantitative data requires statistical analysis such as the calculation of percentages, averages, frequencies (Vaughn, 2018) or regression analysis to estimate data trends (Gühnemann, 2016). The use of statistical software such as SPSS, SAS or Microsoft Excel can be helpful to assess large amounts of data (Vaughn, 2018). The analysis of qualitative data often requires coding and categorizing. Specific software programs can be used to assist in this assessment such as Nvivo, ATLAS-ti or Dedoose (Vaughn, 2018).

The interpretation of data is often based on comparisons. Comparisons can be performed between two similar cases or between the current state and a pre-defined target state, an earlier state of the same situation or a hypothetical state without any measures (Gohl, 2002). Apart from the comparison, one can use process tracing. Here, the causal relation between a project's intervention and its impacts is analysed in small steps to determine whether and to what degree alternative causes for the impacts may exist (Oberndörfer et al., 2010). Conclusions resulting from data analysis should be well-founded and include the presentation of alternatives (Beywl, 2008).

4.5 Information management

Information management is considered as "the most visible part of the M&E system" and important, "because no matter how well data may be collected and analysed, if it is not well presented it cannot be used well" (IFRC, 2011, p. 57). Requirements for a high quality information management are presented in Table 5.

Table 5. Requirements for a high-quality information system.

Requirement	Descriptions	Based on
Clear	Comprehensible language, definition of important terms, use of tables and graphics	Beywl, 2008; Garbutt, 2013
Target-group oriented	Suitable means of communication, language, content and reporting format	Beywl, 2008; IFRC, 2011
Relevant, useful	Focused on specific purposes, avoid unnecessary information overload, well-structured	IFRC, 2011; Garbutt, 2013
Timely	Temporally tailored to the purpose	IFRC, 2011
Reliable	Accurate communication of facts and developments	
Consistent	Use of same units / formats, enable comparisons	
Cost-effective	Balanced relation between relevance, use and resources	

To integrate these recommendations into the information management of an M&E system, a strategy can be developed before starting the reporting process. Here, it is important to differentiate between ***internal*** and ***external*** information management. While the first one supports decision-making and enables learning processes within the project team, the latter is focused mainly on informing stakeholders outside of the involved organization(s). Both target groups have different requirements regarding the frequency, content and format of reporting (IFRC, 2011). Purposes range from

documentation, education, promotion of understanding, creating accountability and transparency (Kusek and Rist, 2004). The results of the M&E process need to be communicated regularly in a condensed and summarized way (Gühnemann, 2016).

A useful means of information management is M&E reporting. Depending on the target group, an M&E report could consist of the following sections (see Table 6):

Table 6. Potential sections of an M&E report.

Chapter title	Remark	Based on
Project information	Short summary about the project	IFRC, 2011
Executive summary	Overview to main activities, findings and recommendations	IFRC, 2011
Introduction	Background and objectives, scope, methods	Waite et al., 2011
Situation / context analysis	Positive / negative factors affecting the program as well as remedial actions	IFRC, 2011
Review of progress and performance	Overview table to progress and performance, divided by columns: • What was planned / agreed upon? • What was achieved? • Reasons for discrepancy • Corrective action (Gohl, 2002)	European Commission, 2004
Stakeholder participation	Information regarding stakeholder involvement, if suitable	IFRC, 2011
Key lessons	Main lessons learned on the basis of M&E results	IFRC, 2011
Recommendations	Clear, user-friendly and action-oriented (Oberndörfer et al., 2010) recommendations regarding planning, imple-mentation, M&E (Waite et al., 2011), associated resource needs and consequences (Kusek and Rist, 2004)	Waite et al., 2011
Conclusion	Conclusion based on explanations	Beywl, 2008
Annex	Additional information	IFRC, 2011

It has to be kept in mind that the way results are communicated influences the perception of information and developments (Gühnemann, 2016). Different ways of communication can be used parallel to reach as many stakeholders as possible (Raymond et al., 2017b). If the information is passed on orally, it might be helpful to provide additional written or graphical records (Gohl, 2002).

4.6 Learning and adaptation

The M&E process does not end with the production of reports (Gohl, 2002). Learning based on insights is important to gain knowledge, improve the project intervention and motivate stakeholders (Kurz and Kubek, 2017). Decisions can be made regarding resource allocation and alternative strategies (Kusek and Rist, 2004). Also, an existing M&E system itself can benefit from proper feedback, as it might be further fine-tuned and improved (Appel, 2002).

There are some preconditions that can support a good learning process. Time is needed for reflection and financial means might be necessary to consult experts. The atmosphere within the organization should allow an open communication about mistakes and weaknesses. Ideally, open discussions are possible and information is handled transparently. It can be useful to schedule regular meetings to discuss monitoring data: *Is the project following the plan? Is an additional evaluation required to assess the causes for certain developments?*

Furthermore, the evaluation results should be discussed to develop recommendations on the future project management process. Stakeholders can especially be involved here to gain additional insights as well as necessary support for further action to be taken (Kurz and Kubek, 2017).

A valuable and common activity to take at this point of time is to execute a lesson learned workshop, which can serve to thoroughly discuss M&E results, draw conclusions, and plan for further action to be taken. The timing of such a workshop depends on the frequency of evaluation and could, for example, take place annually (Guijt and Woodhill, 2002).

5 Contemporary practice of M&E related to participatory processes in environmental decision-making

Environmental problems are characterized by "complexity, uncertainty, large temporal and spatial scales, and irreversibility" (Van den Hove, 2000, p. 458). Those physical features have consequences for the social dimensions of environmental problems as well. Conflicts commonly arise between the interests of different actors regarding the problem itself and potential solutions. As environmental problems are cross-sectoral and knowledge on them often limited, solutions to them should incorporate perspectives from a variety of stakeholders and consider all kinds of information available as well as different values and logics (Van den Hove, 2000). This is especially valid for selecting and co-designing NBSs as they have to consider local natural and cultural site conditions (Cohen-Shacham et al., 2016). Furthermore, these conflicts are intensified by the long time-span of environmental issues. While solutions might be cost-intensive or in other ways inconvenient in the short-term, benefits will often be generated in the long-term only (Van den Hove, 2000).

Van den Hove (2000) summarizes this situation in the following way: "it appears that the problem-solving processes we need to confront environmental issues should be built as dynamic processes of capacity-building, aiming at innovative, flexible and adjustable answers; allowing for progressive integration of information as it becomes available, and of different value judgement and logics; while involving various actors from different backgrounds and levels" (Van den Hove, 2000, p. 462). This necessity has also been embodied in laws. For example, the Aarhus convention, which came into force 2001, highlights the need for participation in environmental decision-making by declaring it as statutory right (European Commission, 1998).

Despite the acknowledged importance of stakeholder participation in environmental decision-making, there is still uncertainty about the way the public can be involved most appropriately. While opportunities to participate may be developed, they also have to be accepted and used (Stringer et al., 2006). Thus, M&E of participation and as a consequence "learning and applying lessons" (Larson and Williams, 2009, p. 260) are crucial to improve environmental decision-making in general as well as related to individual projects.

The present chapter looks into the contemporary practice of M&E related to participatory processes. It is based on a literature analysis which sought to identify approaches and common procedures from grey and scientific literature. As the review yielded no hits when searching for information on M&E of stakeholder participation with direct connection to NBSs in the Living Lab context, literature was consulted dealing with M&E of participatory processes in a more generic manner. By doing so, the following observations were made:

There are different techniques on how to conduct an M&E system. A common differentiation is made between indicator-based approaches and non-indicator-based approaches**. Indicator-based M&E approaches** rest on the formulation of indicators (for a definition, see Glossary and Chap. 5.1.1), which are markers of certain achievements (Working Party on Aid Evaluation, 2002) in relation to desired outcomes.

Non-indicator-based approaches measure the effectiveness of a project in two ways: either they focus on detecting and evaluating outcomes (*Most Significant Change approach, Outcome Harvesting*) or on the process by defining desired changes or causal links and developing an M&E strategy based on these insights (*Outcome Mapping, Causal Link Monitoring*).

For the present deliverable, the indicator-based M&E approach has been the focus of interest, as the review of contemporary practice demonstrated the common use of indicators for M&E purposes. Therefore, the description and further investigation of this approach has been given priority (see Chap. 5.1 and 6). To provide the overall picture and an idea of alternative M&E methods beyond the indicator-based approach, non-indicator-based approaches were also identified from literature analysis (Britt et al., 2017; Davies and Dart, 2005; Earl et al., 2001; Wilson-Grau et al., 2016) and described in short portraits in the Appendix of this deliverable (see Appendix C).

5.1 Indicator-based M&E

Indicators are widely used within M&E systems. They are an integral part of general project management and monitoring guidelines (Beywl, 2008) as well as present within different disciplines ranging from international aid projects (Waite et al., 2011) to rural development (Biancalani et al., 2004), sustainable mobility (Gühnemann, 2016) and other thematic areas. The use of indicators is also common within M&E approaches which assess participatory planning (Faehnle and Tyrväinen, 2013; Innes and Booher, 1999; McCool and Guthrie, 2001; Nabatchi, 2012).

According to Rowe and Frewer (2004), one of the first tasks is to specify when a participatory process is judged as *successful* or *effective*. Such a theoretical mark is needed as a basis for assessing performance. However, the variety of methods, potential criteria as well as stakeholders and their perspectives make it difficult to create a universal definition of *success* (Späth et al., 2014; see also Chap. 7.1). Therefore, indicators can be used in order to approximate a more holistic definition.

5.1.1 Indicator definition and development

An indicator is a "[q]uantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention, or to help assess the performance of a development" (Working Party on Aid Evaluation, 2002, p. 25). Indicators are used to provide information about a situation (Carr et al., 2012) as well as to measure progress (Grunwald et al., 2011). Thereby they generate an understanding for complex aims or results, which are difficult to be measured directly (Hoffmann et al., 2009). Thus, indicators can be interpreted as

"simplified representations of a complex reality" (Herweg et al., 1999, p. 23). During the planning phase, indicators can be suitable to describe the starting situation and thus to formulate precise targets. In the course of a project's implementation, they are mainly used to monitor progress (Kurz and Kubek, 2017). Herein indicators do not only contribute to knowledge and process experience, but they may also serve as a basis for project adaptation and the communication of M&E findings (Kusek and Rist, 2004).

Indicator formulation is not an exclusively scientific or project team-internal process (Kirchner-Heßler et al., 2007) as this step calls for discussion and deliberation with stakeholders for fully reflecting their expectations, demands and definition of a project intervention's success (see Chap. 7.3 and 8).

Indicators should thus be developed as early as possible, ideally within the second step of an M&E framework's planning (see Chap. 4, Fig. 3). According to Gühnemann (2016), indicators should be devised based on specific objectives. She recommends to define one to three indicators for each objective and to formulate clear target values or directions of development for each of them. The number of indicators required per objective depends on the objective's complexity (Kurz and Kubek, 2017). Grunwald et al. (2011) suggest to create indicators based on the question "[H]ow can we observe change in this area of observation?" (Grunwald et al., 2011, p. 40). However, in order to be able to detect unexpected impacts, additional indicators should be used to allow for more in-depth insights (Gohl, 2002). Importantly, when developing appropriate indicators one should consider the effort needed for receiving, assessing as well as reporting the data and make sure the M&E boundaries go hand in hand with the available resources (Kurz and Kubek, 2017).

In this context, Kusek and Rist (2004, p. 71) put forward a series of guiding questions that assess the choice of an indicator as follows:

"Is the indicator…

…as direct as possible a reflection of the outcome itself?

…sufficiently precise to ensure objective measurement?

…calling for the most practical, cost-effective collection of data?

…sensitive to change in the outcome, but relatively unaffected by other changes?

…disaggregated as needed when reporting on the outcome?"

A definition of each indicator should be provided to ensure that different stakeholders interpret the indicator in the same way (Singh et al., 2017). Moreover, it should be clearly outlined how, by whom and with what frequency indicators are measured (Singh et al., 2017). To track progress efficiently, target values need to be formulated, which break down the intended achievement of the overall objectives into gradual steps (Kusek and Rist, 2004). If deemed suitable, it may furthermore make sense to subscribe weights to evaluation criteria. Whether criteria are seen as more important than others should

hereby be decided by the M&E team (Abelson and Gauvin, 2006), ideally in close cooperation with relevant stakeholders.

After a decision has been made regarding the indicators and their details of measurement, analysis and reporting, an indicator set should be tested, thus enabling to prove the usability thereof. For detecting developments in the course of a project intervention's implementation, baseline data needs to be collected at the outset (Grunwald et al., 2011). In case the acquirement of data for an indicator turns out to be too expensive, time-intensive or too complex (Kusek and Rist, 2004), an appropriate adaptation of the indicator set is indicated (see also Chap. 4, Fig. 3).

The definition of evaluation criteria as well as their operationalization via indicators might be controversial due to the complexity of a subject. Alternative or additional indicators can prove to be more suitable, for instance. However, before deciding to exclude or modify an indicator, Kusek and Rist (2004) recommend to perform three measurements to get an idea of the state as well as a possible trend that the indicator might show. The indicator system should not be changed too often to prevent unevenness regarding data and its collection.

As for the inclusion of stakeholders in the step of indicator formulation, there are several variants. One possible approach is to establish working groups (e.g., Kirchner-Heßler et al., 2007), or to consider stakeholders in individual sessions such as in the project design as suggested by Meo et al. (2017). They presented a list of indicators to a group of stakeholders who discussed and adapted the list according to their own perspectives. The formation of focus groups for this purpose can also be useful. Opposed to this approach, Kurz and Kubek (2017) recommend collecting all ideas regarding potential indicators for certain objectives before these ideas can be structured and defined. Another option is to involve participants in the definition of target values and the determination of measurement strategies (Kusek and Rist, 2004).

5.1.2 Requirements of "good indicators"

Numerous frameworks are suggested that summarize requirements for indicator development. The two most common approaches identified from the literature review conducted for this deliverable are the SMART and SPICED approaches (see Table 7).

The literature reflects various opinions regarding the difference between these two approaches. Some authors point out that these sets of requirements differ regarding the kind of indicators for which they are suitable. The SMART approach is suggested to aim at indicators which assess concrete results and thus seems suitable for indicators being of a more quantitative nature. In comparison, the SPICED requirements are recommended for indicators which assess change (MDF, 2005), being based on qualitative data mainly (Singh et al., 2017). Other authors argue that SMART is the standard guideline which can also be used to determine an indicator´s suitability, while the SPICED approach has a stronger participatory focus.

Table 7. Requirements of a "good indicator" reflected by the SMART and SPICED approaches: a comparison.

SMART	SPICED
Specific: An indicator should be clearly defined (Kurz and Kubek, 2017; Naswa et al., 2015).	**Subjective**: Indicators should consider the insights of participants. Thus, different perspectives and various kinds of knowledge are included. Moreover, this strategy can save resources in the long term (Naswa et al., 2015).
Measurable: A suitable method should exist to assess whether indicator targets are met at reasonable expenses and with the necessary precision (Kurz and Kubek, 2017). Measurements should be repeatable, objective and allow for comparisons (Naswa et al., 2015).	**Participatory**: Stakeholders should be involved in the development of indicators (Naswa et al., 2015). Different interests need to be represented (Bours, 2014).
Achievable / Attainable: The implementation of the indicator should be technically and financially possible (UKaid and United States Institute for Peace). Moreover, the target should be set realistic (Grunwald et al., 2011). Grunwald et al. (2011) use the term *acceptable* and define this requirement as the indicator being accepted by the stakeholders.	**Interpreted and communicable:** The indicators have to be interpreted and communicated within their contexts (Naswa et al., 2015). As they should be defined locally, they might have to be explained to others (Bours, 2014). Moreover, their interpretation should serve as an approximation of the fulfilment of a certain objective (Larson and Williams, 2009).
Relevant: The indicator should be a valid and appropriate measurement for the defined objectives (Naswa et al., 2015). Moreover, the indicator should be relevant to the objective and stakeholders (Larson and Williams, 2009).	**Cross-checked / communicable and compared:** The validity of an indicator should be checked by a comparison with other indicators, amongst different stakeholders (Naswa et al., 2015) or by the use of other methods (Bours, 2014). They should be comparable over time and space as well as communicable(Larson and Williams, 2009).
Time-bound: The formulation of an indicator should include a realistic temporal period for its achievement (Naswa et al., 2015). The insights should be available in a way that they can influence the progress and decisions (UKaid and United States Institute for Peace). Kurz and Kubek (2017) argue that this requirement does not make sense for every indicator.	**Empowering:** An indicator allows participants to reflect on the changes appearing through the project (Bours, 2014).
	Diverse and disaggregated: The set of indicators should be diverse to capture different conditions and developments (Naswa et al., 2015). Moreover, differences should be trackable over time (Bours, 2014).

No matter whether the SMART, the SPICED, or a combination of both approaches is used, there are some basic scientific quality criteria which have to be fulfilled by every indicator and the method of measurement: *validity*, *reliability* and *sensitivity*.

Validity: An indicator can be considered valid if it measures exactly what it was intended for (CDIE, 1998). It should accurately reflect the real situation (Levinson et al., 1999).

Reliability: An indicator is reliable if its measurement process is consistent. Every time an indicator is used it achieves the exactly same value under the precondition that there is no change in the parameter it aims at (CDIE, 1998). Thus, results have to be independent of the person who gathers the data (Levinson et al., 1999).

Sensitivity: An indicator should contain the ability to illustrate differences (Fayers and Machin, 2007). Even a small change in the parameter should be reflected in the indicator value (WWAP, 2003).

5.2 Common data collection methods and display options

The choice of methods to acquire and display M&E data depends on the availability of data, financial and temporal resources as well as knowledge about framework conditions and interdependencies. All methods should be objective, reliable and valid (Appel, 2002). The selected tools have to be adapted to the aims, the organizational and temporal framework as well as to the stakeholders involved (Appel, 2002; Kirchner-Heßler et al., 2007). Ideally, methods will be tested beforehand to assess whether accurate results are achievable (Rowe and Frewer, 2004). In practice, it has proven useful to combine different methods for being able to compare and supplement M&E results (Abelson and Gauvin, 2006; Blackstock et al., 2007; Hoffmann et al., 2009). Thereby, the understanding is deepened and the validity of the M&E process increased (Blackstock et al., 2007). Moreover, instruments should aim at involving different stakeholders of the process (Abelson and Gauvin, 2006) to include their concerns and needs. Methods that can be used during different points in time are especially suitable to detect and understand developments (Blackstock et al., 2007).

In Tables 8 and 9 and Appendix B of this deliverable, methods of data collection and display options being frequently applied for M&E purposes related to participatory processes have been compiled and shortly described on the basis of the employed literature review. As Table 8 illustrates, there is a variety of **data collection methods** which can be used for different purposes; among them, methods most commonly discussed in M&E literature are *interviews* and *surveys*. While interviews deliver qualitative information of key stakeholders, for example regarding possibilities to improve a Living Lab process, they can hardly be implemented on a large scale to assess the general satisfaction of Living Lab participants. However, this could be done efficiently by using surveys. Moreover, surveys enable data acquisition regarding specific indicators (Guijt and Woodhill, 2002). If sufficient resources are available, this approach could be supplemented by other methods such as self-documentation or focus group discussions.

Table 8. Overview to common Data collection methods used in M&E.

Method	Use for	Scope	Advantages	Disadvantages
Focus group discussion	• Exchange of different perspectives • Learning • Joint development of solutions (Kurz and Kubek, 2017)	6-12 participants of different background (Charnley and Engelbert, 2005)	• Learning process (Kurz and Kubek, 2017) • Possible in case of limited resources (Vaughn, 2018) • High level of detail • High efficiency (many opinions at once) (Grunwald et al., 2011)	• Potential group influence • Difficult to analyse (Kurz and Kubek, 2017) • Need of a skilled facilitator • Limited number of questions (Grunwald et al., 2011)
Informal conversation	• Validation of information • Insights about unintended consequences of the project (Kurz and Kubek, 2017)		• Low requirements regarding resources, knowledge (Kurz and Kubek, 2017)	• Limitations to generalize insights • Consideration of privacy policy (Kurz and Kubek, 2017)
Interview	• Insights in different perspectives / opinions • Identification of possibilities for improvement (Kurz and Kubek, 2017)	Individually, in a group (Kurz and Kubek, 2017); structured, semi-structured (Vaughn, 2018), open (Grunwald et al., 2011)	• Insights from experts and other key stakeholders • Low costs compared to other methods • Possibility to deepen questions in case of ambiguities (Kurz and Kubek, 2017) • High level of detail (Grunwald et al., 2011)	• Time-consuming • Difficult to analyse • Need of a skilled interviewer (Kurz and Kubek, 2017) • Potential bias of answers (Echternacht et al., 2016)
Observation	• Verification of survey answers • Supplement to information (Kurz and Kubek, 2017) • Insights about a project's operation (Hughes and Niewenhuis, 2005)	Participatory, non-participatory (Gauthier and Volle, 2014)	• Gathering of information which participants do not want to talk about / are unaware of • Understanding about the context (Grunwald et al., 2011) • Direct (Gauthier and Volle, 2014) and accurate information about operationalization • Adaptation possible (Hughes and Niewenhuis, 2005) • Suitability for unstructured, flexible settings (Gauthier and Volle, 2014)	• Resource intensive • Training necessary • Generalization difficult (Grunwald et al., 2011) • Dependence on observers' interpretation • Bias by observation process (Gauthier and Volle, 2014)
Process documents' / secondary sources analysis	• Overview about operation of project (Hughes and Niewenhuis, 2005) • Identification of areas which need further investigation • Assessment of achieved outcomes • Supplementary to primary data (INTRAC, 2017)	Process documents such as concepts, reports, protocols (Kurz and Kubek, 2017); Databases (Hughes and Niewenhuis, 2005), official statements, existing literature, newspaper articles (Hoffmann et al., 2009)	Participatory documents' analysis: • Use of existing information • Reduced bias (Hughes and Niewenhuis, 2005) Secondary sources analysis: • Resource-efficient (Hughes and Niewenhuis, 2005)	Participatory documents' analysis: • Time consuming • Possibility of incomplete information • Reduced flexibility, restriction to existing data (Hughes and Niewenhuis, 2005) Secondary sources analysis: • Unclear validity, reliability of secondary sources • Limited availability of secondary sources (Hughes and Niewenhuis, 2005) • Need to be supplemented by other methods • Ethical issues: Use of data / sources for other than originally intended purposes (INTRAC, 2017)
Self-documentation	• Collection of feedback in real time (Echternacht et al., 2016)	Online, offline, 3-4 questions (Echternacht et al., 2016)	• Reduced bias • Capture of immediate reactions (Echternacht et al., 2016)	• Potential decline of motivation over time • Difficulty to react fast (depending on collection frequency) (Echternacht et al., 2016)
Survey	• Determination of satisfaction • Development of knowledge • Detection of developments (Kurz and Kubek, 2017)	Online, postal, in-person (Vaughn, 2018); structured, semi-structured (Grunwald et al., 2011)	• Assessment of multiple stakeholders at once • Anonymity, depending on approach (Vaughn, 2018) • Cost-efficiency • Easy to analyse • Reduced bias (if not conducted in person) (Grunwald et al., 2011)	• Restriction of answer possibilities • Potential low response rate • Lack of possibility to deepen questions in case of ambiguities (Kurz and Kubek, 2017) • Resource intensive (Carr et al., 2012)

There are also various ways of displaying M&E results. The **display options** presented in Table 9 are those which were most often encountered during the literature review.

Table 9. Overview to common Data display options used in M&E.

Method	Short description	Reference
Indicator reporting	Tracking an indicator's values over time, e.g. in table format. Thus, an overview to the indicator's development is created.	Gohl, 2002
Spider web diagram	Comparison of several indicators at a glance by illustrating their values on a standardized scale within the same diagram, enabling a quick overview about strengths and weaknesses within a project.	Guijt and Woodhill, 2002
Traffic Light System	Illustration of the development of indicators according to different approaches (see Table 10) while using the traffic light colours to provide a quick overview.	CIToolkit, n. Y.
Stakeholder Monitoring Graph	Display of stakeholder relationships including their strength of relationship, salience and hierarchical position.	Van der Jagt et al., 2019

A more detailed description of M&E data display options can be found in Appendix B. Different approaches on how to use and interpret the colours within the traffic light system are depicted in Table 10.

Table 10. Overview to different interpretation approaches of the Traffic Light System.

	Comparison-to-overall-aim-approach (Peterjohann, 2016)	Development-trend-approach (DEFRA, 2013)	Comparison-to-target-approach (CIToolkit, n. Y.)
Red	There is a high uncertainty whether the aim can be reached. Action is urgently needed.	The values of the indicators reflect an undesirable direction of development.	Performance is severely below target.
Yellow	There is uncertainty whether the aim can be reached. Action is needed.	The values of the indicators did not / hardly change compared to the desired direction of development.	Performance is slightly below target.
Green	There is certainty that the aim is achieved. Action is not needed.	The values of the indicators improved compared to the desired direction of development.	Performance meets / exceeds target.

Graphical illustrations of M&E findings as the presented ones can be integrated into M&E reporting at ease, and provide a basis for discussion of further action to be taken with relevant stakeholders.

5.3 Possible pitfalls and ways to overcome

While an M&E system has definite advantages for supporting the efficiency of a project intervention (see Chap. 3.1 and 3.3), respective pitfalls and challenges are also reported in the literature. Gühnemann (2016) differentiates potential pitfalls into the four categories *attitudinal*, *institutional*, *financial* and *technological* challenges. This is extended by *methodological* challenges in this chapter.

Attitudinal challenges

Lack of commitment: Stakeholders as well as the general project organizers might be unwilling to engage in M&E, especially if it involves extra effort (Rowe and Frewer, 2004) or if they think that decisions were already made (Richards et al., 2007). Another reason for a lack of commitment can be missing interest in the M&E topic (Austrian Development Agency, 2008). Clear objectives as well as a high quality of communication (Gühnemann, 2016) might reduce the problem. Moreover, the M&E system should be designed in a simple yet useful way (Grunwald et al., 2011).

Opposition: Depending on their involvement stakeholders might fear that M&E, e.g. related to a participatory process, will uncover the process' weaknesses (Appel, 2002; Austrian Development Agency, 2008). If stakeholders perceive the M&E system as focusing on controlling instead of joint learning and reflecting, they will less likely engage and thus limit their ability to have a say in the project's adaptive and possibly innovative development (Guijt and Woodhill, 2002). A high degree of accountability as well as transparency regarding positive and negative results have to be ensured (Kusek and Rist, 2004).

Power inequalities: A lack of balance between different stakeholder groups can prevent a strong engagement in M&E as well. It has to be ensured that marginalized groups can participate on an equal ground with more powerful stakeholders (Reed, 2008). An awareness of potential conflicts between different stakeholders can contribute to overcome this challenge (Larson and Williams, 2009) as the facilitator can pay attention to potential signals and thus take countermeasures at an early stage.

"Personal" differences: Stakeholders will have various expectations, priorities, aims and needs regarding M&E of a project intervention as well as different skills to express them (Gohl, 2002). Therefore the whole M&E approach might become complex and overloaded (Austrian Development Agency, 2008). To be able to manage expectations in a fair way, clear and realistic objectives should be formulated at the start (Richards et al., 2007). Moreover, it is wise to seek for a consensus among the involved parties when the purpose, scope and M&E boundaries are set.

Institutional challenges

Lack of cooperation between institutions: Monitoring and evaluating a project can require or be enhanced by the cooperation between different institutions. A functioning collaboration as well as a support and acceptance of potential insights is more likely when cooperation and involvement start early in the process (Gühnemann, 2016). In the context of transdisciplinary and international projects it has been observed that socio-

cultural sensitivity is a key factor for effective communication and cooperation on M&E (Vilsmaier, 2017). The clarification of perceptions related to M&E is a fundamental basis for further cooperation (Guijt and Woodhill, 2002).

Financial challenges

Lack of resources: A lack of time, missing expertise and other resources can cause an insufficient M&E process. Kurz and Kubek (2017) recommend in case of limited financial means to only monitor and evaluate a small but relevant part instead of gathering data of the whole project. Moreover, existing data might be used and the sample size can be reduced. Time constraints might also be balanced out by applying quick data collection methods (PATH, 2013) (see Chap. 5.2 and Appendix B). Moreover, a well-structured process (Gühnemann, 2016) as well as clearly defined roles and responsibilities (Kusek and Rist, 2004) minimize this challenge by reducing the resources needed.

Technological challenges

Lack of experience or knowledge: Deficient experience may result in different (preventable) drawbacks. The lack of adapting evaluation criteria and indicators to the project can lead to missing the aims of the M&E framework (Faehnle and Tyrväinen, 2013). Other mistakes are unclear responsibilities, deficient communication and transparency or a shortage of learning from M&E insights (Austrian Development Agency, 2008). An early identification and thus consideration of missing knowledge or experience is important. Mentoring, support as well as feedback need to be provided to the responsible persons. Experts can be involved if necessary (Lahey, 2015). Moreover, training can be performed (Larson and Williams, 2009) or manuals be considered (Mackay, 2007).

Availability of data: The insights resulting from an M&E system can be limited if the collected data proves to be irrelevant or if the tools do not measure the intended outcomes. The availability and accessibility of the existing data thus needs to be determined (Australian Government, 2013). Moreover, it can be useful to test "the data sources, collection and analysis strategies" (Kusek and Rist, 2004, p. 86). The careful planning and design of the M&E framework is therefore especially important for data collection.

Methodological challenges

Duration of the project: It can be difficult to assess the long-term impacts of a project intervention as they might show only after the project's completion (Appel, 2002; Kirchner-Heßler et al., 2007). It can thus be helpful to announce at the end of the project that stakeholders will be contacted again at a certain point of time after the project's closure (see also Chap. 4.2, *Ex-post evaluation*). A good maintenance of the contact database is crucial for this purpose (Kurz and Kubek, 2017). If such an approach is not feasible, approximations need to be used which assess the progress towards a certain long-term objective (Christiansen et al., 2016).

Assessment of causal relationships: Gaining knowledge about interdependencies and causal linkages might pose a challenge (Appel, 2002). However, these insights are often important to be able to interpret the M&E results (Faehnle and Tyrväinen, 2013) and relate potential changes to the measures performed during the project (Oberndörfer et al., 2010). Outcomes might also be linked to other factors or developments beyond a project intervention's reach (Rowe and Frewer, 2004). Stockmann (2004) judges this challenge to be one of the most difficult tasks of M&E as only an experimental approach with the control of variables and randomization would be able to document a sound cause-effect relationship. Techniques which provide information about cause-effect relationships such as the Logical Framework Approach (European Commission, 2004) or the Result Chain Approach (GTZ, 2008) are concepts being applied in project practice to deal with this bottleneck (Stem et al., 2003).

Lack of conceptual clarity: A common challenge within an M&E-system is also to determine which developments are interpreted as success and to create benchmarks being used to track these developments (Villanueva, 2010). An additional challenge can be the change of aims in the course of time (Stockmann, 2004). A careful design of the M&E framework and an effective communication are possible ways to overcome this challenge.

Lack of learning: As M&E is traditionally used as a framework generating control and accountability, the establishment of a learning process can prove to be difficult (Tuckermann, 2007). The creation of a report scheme which includes guidance on how recommendations originating from M&E should be used can be advantageous (Lahey, 2015). Moreover, reflection and dialogue can be actively supported. The professional performance of a facilitator might motivate stakeholders to contribute to and engage in the learning process (Tuckermann, 2007).

Participants' satisfaction as a basis for M&E: Coglianese (2002) identifies another challenge of M&E related to participatory processes. She argues that satisfaction with a process and its outcomes amongst participants is no guarantee for a high quality of decisions and that it excludes those stakeholder who do not participate. Even when success is defined beyond the mere satisfaction of stakeholders, participants are involved in judging those dimensions (Coglianese, 2002). Moreover, the exclusion of non-participants can lead to an incorrect picture of the process and its outcomes (Abelson and Gauvin, 2006).

Even though challenges exist when establishing an M&E system, the awareness about them, and careful design of the process as well as considering the solutions discussed in this chapter, can help to overcome them. The benefits highlighted in Chapter 3 outweigh the potential challenges, and the implementation of M&E is widely recommended in scientific literature (Steiner et al., 2000; Annecke, 2008) as well as practitioner guidelines (Guijt and Woodhill, 2002; Paulus, 2008a; IFRC, 2011).

PART B:

M&E OF STAKEHOLDER PARTICIPATION AND USER SATISFACTION WITH LIVING LAB EXPERIENCE IN PHUSICOS

6 Criteria to assess stakeholder participation in PHUSICOS-related contexts

As the literature review of this deliverable demonstrated, indicator-based approaches are frequently used to evaluate the efficiency of stakeholder participation (Faehnle and Tyrväinen, 2013; Larson and Williams, 2009; Nabatchi, 2012). To design an M&E scheme being of the best possible use for PHUSICOS, it was thus a logical step to previously research and gather available knowledge about evaluation criteria and indicators related as closely as possible to the PHUSICOS context. This pool of information (see Chap. 6.2) was compiled to serve two purposes, mainly:

- On the one hand it should allow for getting an overview to evaluation criteria being regarded key for ensuring effectiveness and stakeholder satisfaction in participatory processes in contemporary project practice; and
- On the other hand, it should also be a point of departure to the M&E team being in charge for tracking the progress of PHUSICOS Living Labs for the development of an own set of evaluation criteria and indicators. Corresponding recommendations are described in Chapter 6.3.

Prior to presenting the related pool of evaluation criteria, and shedding light on its potential use in PHUSICOS, some background information is shared on its elaboration and systematization (see Chap. 6.1).

6.1 Introductory remarks to Pool of Criteria

For assembling the pool of evaluation criteria, the following questions were guiding:

- Which areas are covered in M&E systems of other projects being dedicated to foster participatory processes?
- Which evaluation criteria are most commonly considered?
- Which evaluation criteria are used within projects realizing NBSs or using a Living Lab approach?
- Which indicators are assigned to these evaluation criteria?
- How can the indicators be measured?
- Which criteria of this pool are most relevant to PHUSICOS' purposes?

As outlined in the methodology of this deliverable (see Chap. 2), the publications used to answer these questions and to develop the presented pool of criteria originate from a variety of backgrounds. No literature could be found on M&E related to stakeholder participation in NBS design, and only few authors focused on the evaluation of projects implementing NBSs (Raymond et al., 2017a). Due to this limitation, evaluation criteria were filtered from literature being closely related to the PHUSICOS context or deemed likewise useful, such as public participation in general (Campbell and McCormack, 2008; Faehnle and Tyrväinen, 2013; Larson and Williams, 2009; Rowe and Frewer,

2000; Smith, 2009), environmental decision-making or management (Beierle, 1999; Reed et al., 2018; Reed, 2008; Swiderska et al., 2018; Webler et al., 2001; Webler, 1999), landscape planning (Bohnet, 2010; Meo et al., 2017; Moote et al., 1997), resource management (Blahna and Yonts-Shepard, 1989; Dyer et al., 2014; McCool and Guthrie, 2001) and disaster risk management (Samaddar et al., 2017), development cooperation (Lamhauge et al., 2012), transdisciplinary research (Blackstock et al., 2007), infrastructure (Späth et al., 2014) as well as general project management guidelines (Kusek and Rist, 2004).

The screening of relevant literature, which embraced the 22 sources mentioned above, resulted in a pool of M&E criteria consisting of 25 entries (see Tables 11 and 12). Twelve references supplemented this information regarding Living Labs (Borner and Kraft, 2018; Eckart et al., 2018; Malmberg et al., 2017; Rose et al., 2018; Singer-Brodowski et al., 2018) or NBSs (Eggermont et al., 2015; Janzen and Fischborn, 2016; Kabisch et al., 2016; Naumann et al., 2014; Nesshöver et al., 2017; Raymond et al., 2017a; Raymond et al., 2017b). Each criterion was complemented by a short description, corresponding aims, potential indicators[4], potential methods of data collection as well as the references that they were based on (see also Section *Systematization of the Pool of Criteria*).

Differentiation into process- and outcome-related Criteria

The literature analysis indicated, that regarding participatory processes, two pillars are fundamental for M&E: monitoring and evaluating the process itself, as well as the outcomes thereof (Gosling and Edwards, 2003; Hoffmann et al., 2009). Consequently, the pool of evaluation criteria was differentiated accordingly, identifying and assembling criteria suitable to assess the quality of a participatory process on the one hand (Table 11), and criteria adequate to assess the outcomes of a participatory process on the other hand (Table 12).
While process-related criteria assess whether a participatory process is well-managed and -perceived by stakeholders (Gühnemann, 2016), outcome-related criteria can help to track the intended (and unintended) outcomes and effects taking place due to the participatory process of interest (Nabatchi, 2012; Vaughn, 2018).

There are different opinions as to which pillar is more important. Some authors argue that a functioning process ensures desired outcomes while others point out that an outcome might also be dependent on other factors (Rowe and Frewer, 2004) such as events or developments taking place outside of a project's scope of intervention. In recent years both pillars were recognized as being interconnected and relevant to M&E (Samaddar et al., 2017).

In a review of 30 studies covering the period from 1981 to 2004, Rowe and Frewer (2004) discovered that 28 studies used outcome-related criteria, half of the studies a

[4] As evaluation criteria and indicators are usually formulated specifically for each individual project (Waite et al., 2011), information about the operationalization of criteria with indicators was hardly found in the literature. Thus, the indicators presented in Tables 11 and 12 were deduced from general information on how to develop indicators and following the guiding questions by Kusek and Rist (2004) as presented in Chapter 5.2. Our co-author Malin Tiebel compiled this pool of evaluation criteria in the frame of her master's thesis research.

combination of both and two process-related criteria only as a basis for their evaluation. Moreover, a correlation between the satisfaction with the process and the outcome exists (McKinney and Field, 2008).
Therefore, both pillars have been considered in pooling the evaluation criteria to design an M&E scheme for PHUSICOS.

Systematization of the Pool of Criteria

The resulting pool of criteria (see Chap. 6.2, Tables 11 and 12) has been systematized in the same manner for both tables:

In **Column 1**, the reader is informed on the title of the individual evaluation criterion. Each criterion is briefly described (**Column 2**) and if information could be found regarding connections between a certain criterion and the NBS or Living Lab contexts more specifically, this has been presented in the third column (**Column 3**). Moreover, each criterion has been linked to a certain aim (**Column 4**) and further operationalized with indicators (**Column 5**). Here, it is noteworthy that the mentioned indicators have been formulated in a rather generic manner and need to be further adapted, developed and also defined with specific values prior to their use[5].
In **Column 6**, potential methods of data collection are informed. Last but not least, relevant references are listed, from which the criteria and their descriptions have been developed (**Column 7**).

6.2 Pool of Criteria

The following compilation shows criteria commonly used to assess stakeholder participation and user satisfaction within PHUSICOS-related contexts. Tables 11 and 12 together include a total of 25 criteria which are subdivided into 17 process-related and eight outcome-related entries. These criteria cannot be strictly separated but may also show overlaps, as they partly depend on or supplement each other.

The decision on what criteria is to be regarded as most important poses a challenge on the background that M&E criteria should directly relate to individual project aims and be developed accordingly (see Chap. 4 & 7). However, as both tables clearly indicate, some criteria are backed by more authors than others, reflecting their relevance in contemporary evaluation practice related to participatory processes.

Below the tables, the criteria are discussed in more detail.

[5] See Chap. 5.1.1 for Indicator development and Chap. 5.1.2 for SMART & SPICED attributes of a “good indicator”.

Table 8. Overview to common Data collection methods used in M&E.

Method	Use for	Scope	Advantages	Disadvantages
Focus group discussion	• Exchange of different perspectives • Learning • Joint development of solutions (Kurz and Kubek, 2017)	6-12 participants of different background (Charnley and Engelbert, 2005)	• Learning process (Kurz and Kubek, 2017) • Possible in case of limited resources (Vaughn, 2018) • High level of detail • High efficiency (many opinions at once) (Grunwald et al., 2011)	• Potential group influence • Difficult to analyse (Kurz and Kubek, 2017) • Need of a skilled facilitator • Limited number of questions (Grunwald et al., 2011)
Informal conversation	• Validation of information • Insights about unintended consequences of the project (Kurz and Kubek, 2017)		• Low requirements regarding resources, knowledge (Kurz and Kubek, 2017)	• Limitations to generalize insights • Consideration of privacy policy (Kurz and Kubek, 2017)
Interview	• Insights in different perspectives / opinions • Identification of possibilities for improvement (Kurz and Kubek, 2017)	Individually, in a group (Kurz and Kubek, 2017); structured, semi-structured (Vaughn, 2018), open (Grunwald et al., 2011)	• Insights from experts and other key stakeholders • Low costs compared to other methods • Possibility to deepen questions in case of ambiguities (Kurz and Kubek, 2017) • High level of detail (Grunwald et al., 2011)	• Time-consuming • Difficult to analyse • Need of a skilled interviewer (Kurz and Kubek, 2017) • Potential bias of answers (Echternacht et al., 2016)
Observation	• Verification of survey answers • Supplement to information (Kurz and Kubek, 2017) • Insights about a project's operation (Hughes and Niewenhuis, 2005)	Participatory, non-participatory (Gauthier and Volle, 2014)	• Gathering of information which participants do not want to talk about / are unaware of • Understanding about the context (Grunwald et al., 2011) • Direct (Gauthier and Volle, 2014) and accurate information about operationalization • Adaptation possible (Hughes and Niewenhuis, 2005) • Suitability for unstructured, flexible settings (Gauthier and Volle, 2014)	• Resource intensive • Training necessary • Generalization difficult (Grunwald et al., 2011) • Dependence on observers' interpretation • Bias by observation process (Gauthier and Volle, 2014)
Process documents' / secondary sources analysis	• Overview about operation of project (Hughes and Niewenhuis, 2005) • Identification of areas which need further investigation • Assessment of achieved outcomes • Supplementary to primary data (INTRAC, 2017)	Process documents such as concepts, reports, protocols (Kurz and Kubek, 2017); Databases (Hughes and Niewenhuis, 2005), official statements, existing literature, newspaper articles (Hoffmann et al., 2009)	Participatory documents' analysis: • Use of existing information • Reduced bias (Hughes and Niewenhuis, 2005) Secondary sources analysis: • Resource-efficient (Hughes and Niewenhuis, 2005)	Participatory documents' analysis: • Time consuming • Possibility of incomplete information • Reduced flexibility, restriction to existing data (Hughes and Niewenhuis, 2005) Secondary sources analysis: • Unclear validity, reliability of secondary sources • Limited availability of secondary sources (Hughes and Niewenhuis, 2005) • Need to be supplemented by other methods • Ethical issues: Use of data / sources for other than originally intended purposes (INTRAC, 2017)
Self-documentation	• Collection of feedback in real time (Echternacht et al., 2016)	Online, offline, 3-4 questions (Echternacht et al., 2016)	• Reduced bias • Capture of immediate reactions (Echternacht et al., 2016)	• Potential decline of motivation over time • Difficulty to react fast (depending on collection frequency) (Echternacht et al., 2016)
Survey	• Determination of satisfaction • Development of knowledge • Detection of developments (Kurz and Kubek, 2017)	Online, postal, in-person (Vaughn, 2018); structured, semi-structured (Grunwald et al., 2011)	• Assessment of multiple stakeholders at once • Anonymity, depending on approach (Vaughn, 2018) • Cost-efficiency • Easy to analyse • Reduced bias (if not conducted in person) (Grunwald et al., 2011)	• Restriction of answer possibilities • Potential low response rate • Lack of possibility to deepen questions in case of ambiguities (Kurz and Kubek, 2017) • Resource intensive (Carr et al., 2012)

Process-related criteria mentioned by almost a third of the publications and put in order by the frequency of their mention are (see Table 11): *representativeness*, *highly-skilled facilitation of the process*, *provision of learning opportunities*, *continuous and active involvement*, *cost-benefit ratio*, *participants' power to influence*, *resource accessibility and availability*, and *transparency*.

Representativeness: By ensuring the representativeness of a process, a diversity of views are incorporated into the process (Blahna and Yonts-Shepard, 1989), reducing the possibility of not considering important issues (Bohnet, 2010). Additionally, transparency and ownership (Samaddar et al., 2017) as well as equity and credibility are established (Bohnet, 2010);

Highly-skilled facilitation of the process: According to Reed (2008) outcomes of participatory processes are dependent on the way the process is conducted and thus, a highly-skilled facilitation is crucial as it enables meaningful contributions. Consensus[6], accountability and trust as well as a functioning time management can be ensured in this manner (Samaddar et al., 2017);

Provision of learning opportunities: A high quality of participants' contribution can also be achieved by fostering their knowledge and confidence (Reed, 2008). Thus, reflected and informed decisions can be made (Smith, 2009), discussions are enabled and alternatives can be developed (Beierle, 1999);

Continuous and active involvement: Especially against the background of a long and complex process, continuity and the degree of stakeholder involvement is important (Blahna and Yonts-Shepard, 1989). Thereby, ownership and transparency are created;

Cost-benefit ratio: The cost of organizing participation as well as taking part in the process need to be positively related to the benefits gained. If such a condition is not achieved, the motivation might decline among stakeholders (Meo et al., 2017);

Participants' power to influence: By receiving the opportunity to influence the process, participants may change their underlying knowledge and value base of decision-making (Meo et al., 2017). This contributes to ownership building as well as to a positive perception of transparency and accountability (Samaddar et al., 2017);

Resource accessibility and availability: Various resources such as data, time, knowledge as well as financial and other means have to be available (Späth et al., 2014) and equally accessible for participants to engage (Blackstock et al., 2007);

Transparency: The term *transparency* is closely connected to *legitimacy* and can even be considered part of this criterion (Webler et al., 2001). It is essential for establishing trust and confidence amongst stakeholders as well as for countering potential criticism regarding the effect of participation (Smith, 2009).

[6] In this context, a controversial discussion is noteworthy. Within the description of the criterion *highly-skilled facilitation of the process*, it is stated that a skilled facilitator should have the ability to establish consensus amongst stakeholders. However, this statement is contested as there are advantages, but also drawbacks of performing a consensus-based decision-making approach. Such a procedure might lead to the disadvantage that some concerns or issues remain unheard, criticism might be discouraged and consensus is not always possible due to opposing perspectives (Richards et al., 2007). On the other hand there are certain advantages such as the incorporation of various interests, the potential to achieve mutual gain as well as gathering new practices or ideas (Innes and Booher, 1999).

Table 12. Criteria to assess the outcomes of a participatory process.

Evaluation criterion	Description	Connection to NBS / Living Lab (LL)	Aim	Potential indicators	Potential methods for data collection	Based on
Capacity building	The participatory process results in the development and improvement of relationships and skills. Moreover, participants are aware of their own capacities and resources and able to use them. Thus, stakeholders are able to make meaningful contributions to future projects. They are self-reliant, empowered, willing to learn and able to value different perspectives.	Capacity building within the context of NBS is important to increase the ownership as well as to provide opportunities to learn (Raymond et al., 2017a).	The participatory process increases the stakeholders' capacity.	• Development of capacity (extent and quality of contribution to the process, stakeholders' engagement as multiplicators beyond the process) • Perception of development of participants' knowledge, skills by participants, external observers, people responsible for the participatory process • Participants' attitude towards future projects	• Focus-group discussion • Informal conversation • Interview • Process documents / secondary sources analysis • Self-documentation • Survey	Blackstock et al., 2007; Faehnle and Tyrväinen, 2013; Larson and Williams, 2009; Samaddar et al., 2017
Cost-benefit-ratio	Outcomes can be considered cost-effective if the resources used (money, expertise, time,…) are converted into outcomes and if improvements are satisfactory. The cost and benefits of the outcomes are distributed in a socially just way.		The outcomes are achieved in a cost-effective way.	• Documentation of conformity with the resource use plan • Perception of cost-benefit-ratio by participants, external observers, people responsible for the participatory process	• Focus-group discussion • Interview • Process documents / secondary sources analysis • Survey	Blackstock et al., 2007; Dyer et al., 2014; Kusek and Rist, 2004; Samaddar et al., 2017
Innovation	New strategies, activities and ideas are developed, which influence the outcome.	A creative design, achievable by innovations, of NBS makes them more flexible to adapt to developments of the social and economic context (Raymond et al., 2017a). LL often lead to or aim at social or technical innovations (Borner and Kraft, 2018).	The participatory process promotes innovations.	• Perception of degree of innovativeness of outcomes by participants, experts, external observers, people responsible for the participatory process	• Focus-group discussion • Informal conversation • Interview • Process documents / secondary sources analysis • Self-documentation • Survey	Bohnet, 2010
Institutional capital	Institutional capital consists of capacities and skills developed within the institutions by learning from the participatory process. This includes insights about participatory planning and cooperation. Moreover, linkages develop between institutions and they improve their ability to work together. In the future, they are able to manage resources collectively and the trust in them increased.	Kabisch et al. (2016) point out that the collaboration of different actors has the potential to reduce barriers to NBS as the risk can be shared. Moreover, NBS can be designed, delivered and monitored more efficiently (Raymond et al., 2017a).	The participatory process increases the institutional capital.	• Development of cooperation between different institutions • Perception of development of institutions' knowledge, skills, networks by people responsible for the participatory process, external observers	• Informal conversation • Interview • Process documents / secondary sources analysis • Survey	Beierle, 1999; Bohnet, 2010; Faehnle and Tyrväinen, 2013; Lamhauge et al., 2012; Swiderska et al., 2018
Learning	A learning process takes place between participants with different kinds of knowledge and perspectives, but also between stakeholders and researchers. Participants increase their knowledge about the planning process, the context and other thematic issues. Moreover, values and behaviours are influenced. The organizers receive a better understanding of the knowledge and value base by gaining new insights and information that would not be acquired without the participatory process. All parties learn to question the current status and improve their creative thinking. Thus, the process can be further improved and well-considered decisions be made.	It is important to manage stakeholders' perception of NBS. Education and thus a change of the perception is necessary (Raymond et al., 2017b). Moreover, stakeholders have to be aware of the complexity and uncertainty regarding NBS (Eggermont et al., 2015). A positive public perception of NBS should be achieved (Naumann et al., 2014). At the same time, learning is crucial in LL-processes (Singer-Brodowski et al., 2018).	All stakeholders are affected by a learning process, which positively influences their knowledge and skills.	• Definition of learning goals of participants and tracking thereof throughout the process • Perception of degree of change of participants' knowledge, skills, awareness, understanding, values, behaviours by participants, external observers, people responsible for the participatory process • Perception and judgement of learning effect by participants, external observers	• Focus-group discussion • Informal conversation • Interview • Process documents / secondary sources analysis • Survey • Self-documentation	Blackstock et al., 2007; Bohnet, 2010; Faehnle and Tyrväinen, 2013; Larson and Williams, 2009; McCool et al., 2001; Meo et al., 2017; Reed, 2008

Evaluation criterion	Description	Connection to NBS / Living Lab (LL)	Aim	Potential indicators	Potential methods for data collection	Based on
Ownership	The outcomes are socially (across all stakeholder groups) and politically accepted or even widely supported.	The social costs and benefits of implementing NBS are not often considered (Raymond et al., 2017a). A high ownership can serve as an approximation for a positive social cost-benefit relation. The creation of ownership should be an aim within projects implementing NBS (Naumann et al., 2014).	The results of the process are accepted and supported by all stakeholders.	• Degree of support and acceptance of the project, its outcomes by the external public, participants, people responsible for the participatory process (kind of opinions expressed, perception)	• Focus-group discussion • Informal conversation • Interview • Process documents / secondary sources analysis • Survey • Self-documentation	Blackstock et al., 2007; McCool et al., 2001; Samaddar et al., 2017
Participants' impact on outcome	Stakeholders influence decisions and outcomes of the project. Local knowledge, values, needs and concerns are incorporated in the outcome. The quality of decisions and outcomes improves through the participatory process by increasing ownership, establishing new relationships, committing to responsibilities and additional factors. Long-term benefits are produced.	Values and preferences of different stakeholders should be considered in decision-making regarding NBS (Raymond et al., 2017a). Janzen and Fischborn (2016) point out that participation in implementing NBS is crucial to achieve a long-term success of a project A fundamental requirement in LL processes is the co-creation and co-design of outcomes (Malmberg et al., 2017).	The participants have an impact on the outcomes of the process.	• Degree of consideration of participants' contributions in outcomes (documented uptake of participants' priority demands, e.g., in policy papers, planning documents, meeting protocols) • Perception of degree of impact of participants' knowledge, values, concerns on outcomes by participants, external observers, facilitator, people responsible for the participatory process • Support of outcomes by a documented ownership / commitment of stakeholders to maintain / take care of them	• Focus-group discussion • Informal conversation • Interview • Process documents / secondary sources analysis • Self-documentation • Survey	Beierle, 1999; Blackstock et al., 2007; Moote et al., 1997; Rowe and Frewer, 2000; Smith, 2009; Späth et al., 2014; Swiderska et al., 2018
Social capital	Social capital is characterized by establishing new and improved social networks and relationships. Differences between stakeholders are understood and possibilities to find common objectives and work together detected. Mutual trust is generated which results in a greater level of confidence in each other as well as a better collaboration. Understanding, information and data are shared. Thus, social capital can serve as a good cooperation basis for the future.		The participatory process increases the social capital available.	• Development of collaboration (development of communication channels, working groups, relationships, networks) • Perception of development of social capital by participants, external observers	• Focus-group discussion • Informal conversation • Interview • Process documents / secondary sources analysis • Self-documentation • Survey	Blackstock et al., 2007; Bohnet, 2010; Larson and Williams, 2009; McCool et al., 2001; Samaddar et al., 2017; Swiderska et al., 2018; Webler, 1999

Compilation & Design: M. Tiebel 2019.

Compared to the process-related criteria, Table 12 illustrates that the pool of outcome-related evaluation criteria deduced from literature was less extensive. Like previously the case, some outcome-related criteria were mentioned by more authors than others. Almost a third of the sources mirrored the special relevance of the criteria *learning*, *participants' impact on outcome* and *social capital*.

Learning: According to Singer-Brodowski et al. (2018, p. 26) *learning* within Living Labs can be differentiated into "personal competency development, social learning and inter-and transdisciplinary collaboration". Thus, it can also be considered to be an umbrella criterion for *capacity building, institutional capital* and *social capital*.

Participants' impact on outcome: The impact participants might have on outcomes depends on the level of participation chosen and can reach from an increased ownership (Samaddar et al., 2017) due to a good information management to stakeholders having an actual influence on decisions made (Smith, 2009). A consideration of stakeholders' needs and concerns increases the support of outcomes (Moote et al., 1997) as well as their trust (Rowe and Frewer, 2000). Besides, the outcomes' quality might be raised (Beierle, 1999).

Social capital: The improvement of relationships between different stakeholders results in mutual trust and a better collaboration (Blackstock et al., 2007). A greater level of confidence in each other may furthermore lead to a better acceptance of disaster risks and corresponding action (Samaddar et al., 2017). Favourable conditions for future processes are thus generated (Webler, 1999).

Under the more focused lens of a Living Lab approach to co-design NBS, the pooling of criteria from the literature demonstrated that especially the criteria *capacity building*, *innovation*, *learning*, *institutional capital* and *participants' impact on outcomes* are of relevance to be tracked within an M&E scheme.

Some criteria can be found in both tables as they contribute to the success of the participatory process and its outcomes. These are the *cost-benefit ratio* or in slightly modified versions the process-related criteria *provision of learning opportunities* and *participants´ power to influence* which can be related to the outcome-related entries *learning* and *participants´ impact on outcomes*.

All in all, the criteria presented in Tables 11 and 12 have different requirements regarding the manner in which they are operationalized. While potential indicators and collection methods can be identified from the tables, the facilitators being in charge of M&E also have to consider when to assess which criterion. Some process-related criteria, such as e.g. *clear and agreed on objectives from the beginning* or *early involvement*, are connected to the start of a participatory process, while others can be assessed regularly after participatory events. For instance, *fairness and equality* or *representativeness* benefit from frequent assessments. Other process-related criteria, like *legitimacy* or *transparency*, mirror more long-term developments or perceptions. The assessment of outcome-related criteria should not be restricted to one measurement only, as developments originating from the participatory process might still take place after the completion of a project.

6.3 Insights for M&E in PHUSICOS

The presented pool of criteria has been elaborated to serve as a guideline and source of inspiration for the PHUSICOS project and its demonstrator and concept case sites. The criteria were compiled by focusing on literature about participation in general. While they are applicable to a Living Lab approach, such as implemented within PHUSICOS, it should be considered that the aims and evaluation criteria of participation within Living Labs are more far reaching than regular stakeholder engagement (Eckart et al., 2018; Mastelic et al., 2015; Steen and van Bueren, 2017).

Eckart et al. (2018) state that it is characteristic for a Living Lab process to pursue three different types of targets, namely *practice-related* targets, *research* targets and *learning* targets, which are interconnected with each other. By doing so, four main aims of participation should be typically achieved in a Living Lab process:

Knowledge Generation

Insights gained within Living Labs go beyond regular scientific findings, as participatory methods are intentionally applied to enable an elicitation of an extensive experiential knowledge to real-world issues. Local and everyday knowledge as well as practical experiences are collected and communication barriers between science and practice reduced by bringing together people from different backgrounds (Eckart et al., 2018), which opens doors to the generation of new knowledge. This relates to the evaluation criteria *integration of local and scientific knowledge*, *suitable methods* and *learning*.

In PHUSICOS, Living Labs intend to include "the public sector, private sector, users and knowledge institutions" (Fohlmeister et al., 2018, p. 44) into their participatory processes, ideally while achieving representativeness. Herein, the practical insights regarding technical components, potential social and economic impacts are especially important when designing the NBSs. At the same time, an increased NBS acceptance is anticipated (Fohlmeister et al., 2019).

Definition and Co-design of research and practice-related targets

In a Living Lab, scientists and actors with practical experience are meant to work together to define a research and transformation agenda. The solutions to be developed and the questions to be answered are determined in a joint process. Its research and practice-related targets should be oriented by societal as well as scientific needs (Eckart et al., 2018). This aim can be connected to the criteria *clearly-formulated and agreed upon objectives from the beginning of the process*, *continuous and active involvement*, *early involvement* as well as *participants' power to influence*.

Within PHUSICOS key topics to be worked on during the Living Lab processes should also be of joint interest, and stakeholders' priority demands be actively identified, considered and integrated (Fohlmeister et al., 2018).

Empowerment of Innovators

A Living Lab can aim to support innovators during the development and spreading of an innovation. Assistance may for example involve content-related, methodological or organizational support when conducting research or contributing to innovations in another manner. By participating in a Living Lab process, innovators can profit from a facilitated communication and collaboration with other stakeholders. Specifically, the opportunities of contact and exchange with key stakeholders and later users of an innovation can be beneficial and empowering to innovators (Eckart et al., 2018).
This aim of a Living Lab is connected to the evaluation criteria *capacity building*, *highly skilled facilitation of the process*, *innovation* as well as *learning*, *participants' power to influence*, *participants' impact on outcome*, *resource accessibility and availability*, and *social capital*.

PHUSICOS strives to involve stakeholders not only during the NBS implementation but also already during the development of solutions (Fohlmeister et al., 2018). A special consideration shall be given to local Small and Medium Enterprises (SMEs), which are targeted to be fostered by Living Lab activities.

Facilitation of learning processes

Living Labs have the intention to enable learning and to pass on insights gained within the Living Lab research to promote scientific and societal learning. Moreover, they provide a framework for conducting learning beyond the mere information of stakeholders by offering a place for exchange, evaluation and reflection which does not take place within the stakeholders' daily routine (Eckart et al., 2018). Evaluation criteria which relate to this aim are *provision of learning opportunities*, *learning*, *suitable methods*, *capacity building* and *social capital*.

PHUSICOS pursues to establish a sound knowledge exchange between a multitude of actors, and thus to contribute to capacity building within public entities, private enterprises, research institutions and civil society actors. In this way, the awareness of local stakeholders regarding natural hazards and the potential of NBSs shall be raised. Thereby, innovative education and communication strategies are intended to be used. "[F]eedback, evaluation and continuous improvement" (Fohlmeister et al., 2018, p. 44) are considered central to the project strategy of PHUSICOS.

Against this background, it seems of priority importance for PHUSICOS to utilize and monitor evaluation criteria in its M&E system that are capable of tracking progress towards these Living Lab-specific aims outlined by Eckart et al. (2018). However, as the case study sites reflect a high diversity concerning their individual goals connected to stakeholder participation (Fohlmeister et al., 2019), the **Living Lab approach** in PHUSICOS might do well by being interpreted as **continuum** in order to allow for different degrees to which the practice-related, research and learning targets (Eckart et al., 2018) will be met.

More specifically, it would be a reasonable step to take care that practice-related targets, such as the co-design of NBS measures, are equally met at all case sites in the course of the project, while research and learning targets could be given individual weights at the different case sites, depending on being a concept or demonstrator case, for instance. Such an approach would balance out the necessity of giving room to cross-case comparison and ensuring a certain quality standard for all case sites within PHUSICOS on project level, while at the same time taking into consideration the individual case sites' local context and demands.

In synthesis, out of the pool of evaluation criteria which was compiled for this deliverable from contemporary literature (Chap. 6.2), a composition can be deduced of **i) key criteria of an effective participatory process** and **ii) additional criteria being relevant for realizing a Living Lab approach** related to NBSs.

i) Key criteria to monitor and evaluate a participatory process` effectiveness are **Transparency, Representativeness, Legitimacy, Cost-benefit ratio, Highly-skilled facilitation, Participants' power to influence and impact on outcome.** They should be considered the common bottom line for all case sites.

ii) In addition, and especially to track the success of a Living Lab approach related to NBSs, the criteria **Continuous and active involvement**, **Integration of local and scientific knowledge**, **Provision of learning opportunities**, **Capacity building, Learning, Social Capital** and **Innovation** are of high relevance.

Transferred to the M&E task, this means that criteria i) and ii) should be regarded as "set" for all case sites and be covered by the M&E scheme accordingly. An individual extension to the proposed set of criteria should be allowed for at the case sites in order to include the possibly diverging local-specific interpretation of a Living Lab process' *success* when operationalizing the M&E system on local level (see Chap. 7.3).
For this purpose, it is recommended that the Living Lab facilitators exchange with their Living Lab members on what is understood by *successful participation* within their Living Lab process. This can contribute to the discussion on the set of feasible indicators and values to be achieved in the respective local contexts.

As for the data collection methods to assess the mentioned set of criteria, the literature informs many possible options (see Chap. 6.2 and Appendix B), ranging from surveys and self-documentation to documentary analysis and interviews. With glance at the available resources for M&E in PHUSICOS, an easy-to-implement manner of assessing stakeholder participation and user satisfaction would be the use of surveys to be done in the final part of the Living Lab sessions. This could be supplemented by other methods, such as documentary analysis and interviews with key stakeholders, to certain points in time, which deem decisive for the Living Labs' development.

7 Putting M&E into practice for PHUSICOS Living Labs

Taking the pool of evaluation criteria for stakeholder participation and related deliberations for PHUSICOS as a point of departure (see Chap. 6.3), the present chapter intends to distil an appropriate set of indicators that is meant to build the core part of the M&E scheme to be used for assessing stakeholder participation and user satisfaction with the Living Lab experience at demonstrator and concept case sites.

As outlined in Part A of this deliverable (see Chap. 4 & 5), the definition of *what* to monitor and evaluate is project-dependent and as diverse as the one on what to understand by *successful* and *satisfactory* stakeholder participation (Gujit and Woodhill, 2002). Transferred to the PHUSICOS context, different stakeholders may define a successful Living Lab process for NBS co-design completely differently, which is due to a variety of perspectives, underlying values, priorities and interests being involved (e.g., Späth et al., 2014). To address the obvious need of a systematic M&E approach for Living Labs on project level, and the one to fulfil local stakeholders' expectations, this chapter will put forward the M&E scheme as follows:

Connecting to the Document of Action (DoA), sub-chapter 7.1 presents the targets and milestones for PHUSICOS Living Labs, which are considered the decisive orientation for the M&E scheme's design from a project's perspective. It lists the objectives set for Work Package 3 (WP3) *Service Innovation*[7] on behalf of a Result Chain, and consequently highlights areas of importance for tracking the advancement of the Living Lab processes towards their intended targets.

Building on this procedure, sub-chapter 7.2 introduces the proposed M&E scheme, and describes its features more in detail.

To conclude, sub-chapter 7.3 relates back to the necessity of tailoring the M&E scheme to local-specific needs upon its operationalization (see Chap. 4 and 6.3). Here, the facilitation teams of the Living Labs can find hints on how the M&E scheme can be put in practice and be extended in order to address potential additional expectations of their individual stakeholders and Living Lab participants.

[7] According to Document of Action (DoA) PHUSICOS, GA 776681, Part A Work Package 3 Description and Part B, Version 2018 and its amendment.

7.1 What matters to us (I)? Targets and milestones for PHUSICOS Living Labs

From Chapter 6 and the pool of evaluation criteria compiled for this deliverable, a selection of criteria was narrowed down which is key to be covered by the M&E scheme (see Chap. 6.3). To operationalize it for PHUSICOS, it needs to be linked to the objectives that are defined for the Living Labs. Thus, to answer the question *"What matters to us?"* from a project's perspective, the Document of Action (DoA) gives the decisive orientation for this design step of the M&E scheme. It is here where the targets are defined to be achieved by the Living Labs in the course of PHUSICOS.

As illustrated by Table 13, the impact of the Living Labs' work will be assessed by the indicators mentioned in the first column. They have been formulated for Work Package 3 for progress reporting purposes on project level (see Chap. 1.1, Fig. 2).

Table 13. PHUSICOS indicators for assessing WP3's outputs and impacts according to DoA

Indicator	Unit of measurement	Intended Timeframe (M= month)
Uptake of priority demands related to NBS expressed by local stakeholders in Living Labs in policies on land use planning, landscape planning and territorial policies	Number of policy briefs and policy papers reflecting NBS demands formulated by Living Labs of case study sites	M28-M60, post project
Evidence-based assessment of **NBS acceptance** in study areas in terms of their effectiveness to reduce risks	Documentation by interviews with Living Lab participants and other stakeholders	M12-M60
Awareness of Living Lab participants **to natural hazards and NBS** as means of disaster risk management	Documentation by awareness assessments with Living Lab participants	M15-M60
Living Labs catalyse **exchange with local SMEs** for NBS solutions	Number of SMEs included in Living Lab activities at case study sites	M12-M60, post project
Mention of Living Lab user satisfaction and experience to **build up capacity** in more flexible disaster risk management	Documentation by Living Lab user satisfaction	M15-M60
Uptake of priority demands and topics related to NBS expressed by local stakeholders and degree of consideration in a protocol for environmental and financial policy mechanisms	Number of priority demands expressed by Living Lab participants and included in protocol	M40-M60, post project

It becomes evident that especially the identification of **stakeholders' priority demands and their visible uptake** as well as **capacity-building**, **learning and awareness-building on NBSs** are regarded as decisive results.
Furthermore, the DoA highlights the importance of **iterative knowledge exchange and co-creation** by recommending at least two large Living Lab events per case site and year with the project's Work Packages for the demonstrator case sites to foster **local innovation capacity**.

Synthesizing relevant targets to be achieved by the PHUSICOS Living Labs into a Result Chain[8] (e.g., GTZ, 2008; Paulus, 2008a; Reuber and Haas, 2009), the main M&E areas of interest are illustrated in Fig. 4:

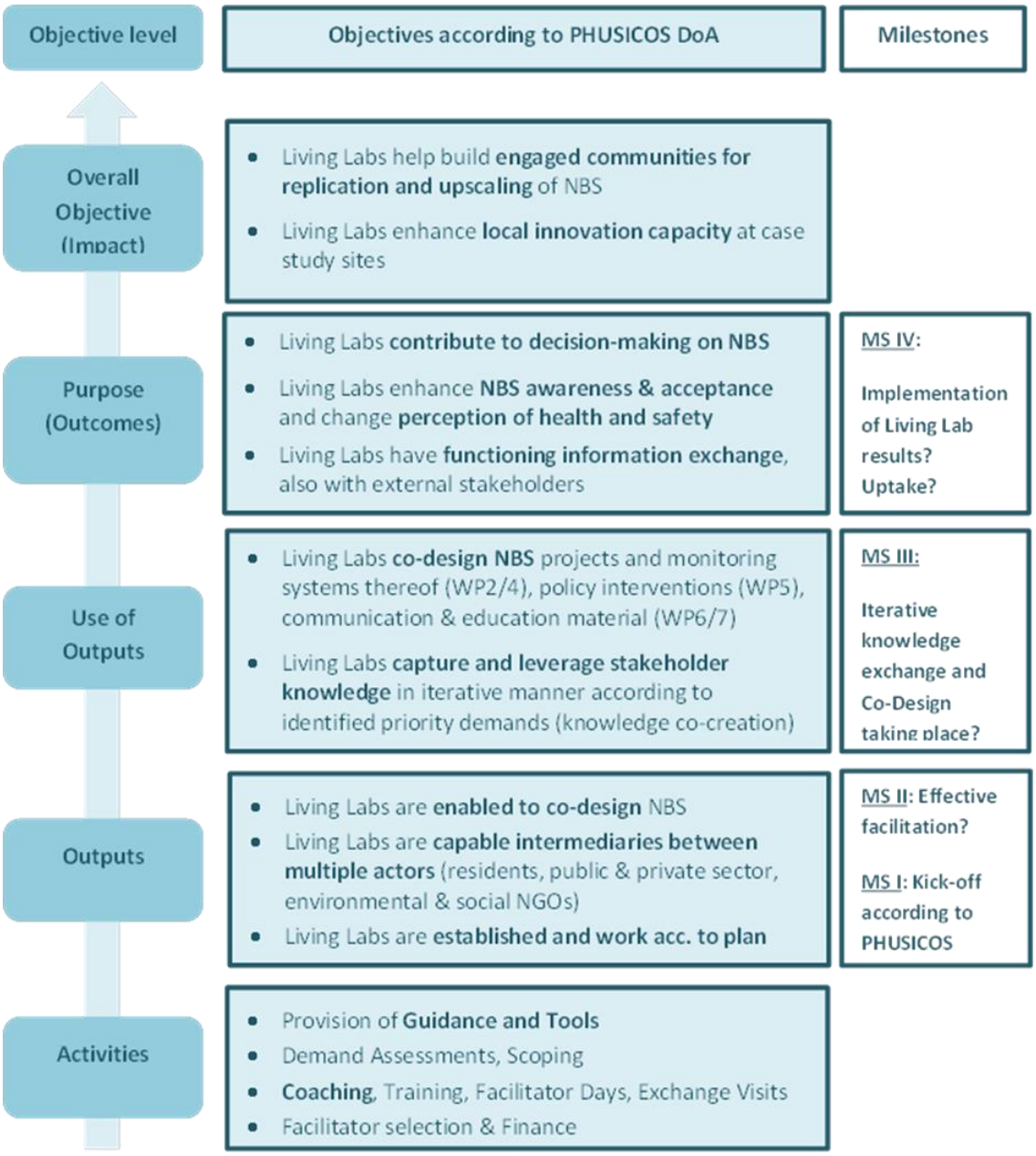

Figure 4. Targets and milestones for PHUSICOS Living Labs displayed as a Result Chain. (Milestone (MS I-IV) formulation inspired by Van der Jagt et al., 2017; Design: S. Fohlmeister 2019).

[8] The Result Chain is a common approach in International Project Cycle Management and Monitoring, which explains the causal relationship between a project`s intervention and its results in several stages. The model usually works with five to six stages, describing a project's inputs and activities, its outputs (= deliverables), the use of outputs, the outcomes (= direct impacts, purpose of project intervention) and impacts (=indirect impacts, overall goal/objective). By making transparent the intervention in this way, relevant M&E areas can be depicted and indicators deduced.

Based on the Result Chain (see Fig. 4), as a next step performance questions can be formulated related to each objective level and corresponding objectives (see Table 14). This interim step on the way to the creation of indicators is meaningful in order to distil the relevant areas for performance assessment and avoid overloading an M&E scheme with too many indicators. Following the principle of "less is more" (Gujit and Woodhill, 2002; p. 5-12), these performance questions can help to focus on the relevant information the M&E scheme should be able to generate.

Table 14. Objectives and corresponding performance questions for PHUSICOS Living Labs.

Objective level	Objectives	Potential performance questions
Overall objective (Impact)	Living Labs help build **engaged communities for replication and upscaling** of NBS	Which NBS have been committed to be up-scaled/replicated, by whom and where? Has engagement visibly increased?
	Living Labs enhance **local innovation capacity**	How do local innovators (e.g. SMEs) profit from Living Lab activities?
Purpose (Outcomes)	Living Labs **contribute to decision-making on NBS and other innovations**	Which decisions have been influenced by Living Labs and to what extent? How many stakeholder demands have been considered (e.g. in the PHUSICOS research agenda, policy papers)?
	Living Labs enhance **NBS awareness & acceptance** and **perception of health and safety**	How have NBS acceptance / awareness / perception of health and safety changed? To how many people do the changes refer?
	Living Labs have **functioning information exchange**	To what extent are there changes in stakeholder cooperation/networks?
Use of Outputs	Living Labs **co-design NBS** projects and other WP products	What has been co-designed and to what extent? How many and which type of stakeholders have been included in the co-design process? Who was excluded and why?
	Living Labs **capture and leverage stakeholder knowledge** in an iterative manner	Which new knowledge has been created? Do stakeholders perceive a real iterative exchange of knowledge taking place? Which share does local knowledge have?
Outputs	Living Labs have **enabled the co-design** NBS	What skills have been improved among Living Lab facilitators and participants? Is there a need of these skills?
	Living Labs are **capable intermediaries between multiple actors**	How many different stakeholder types do the Living Labs orchestrate? Are all relevant stakeholders included? Who has been excluded and why? Do stakeholders feel that the Living Lab facilitation is well done?
	Living Labs are **established and work according to plan**	How many Living Labs have been established according to the PHUSICOS quality standard (intended timeframe)?
Activities	**Guidance and Tools**, Demand Assessments, Scoping, **Coaching**, Training, Facilitator Days, Visits, Facilitator selection & Finance	What does the project team do and deliver? Who are the beneficiaries?

Subsequently, indicators can be devised that correspond to the different objective levels and milestones of the PHUSICOS Living Lab project intervention (see Fig. 5):

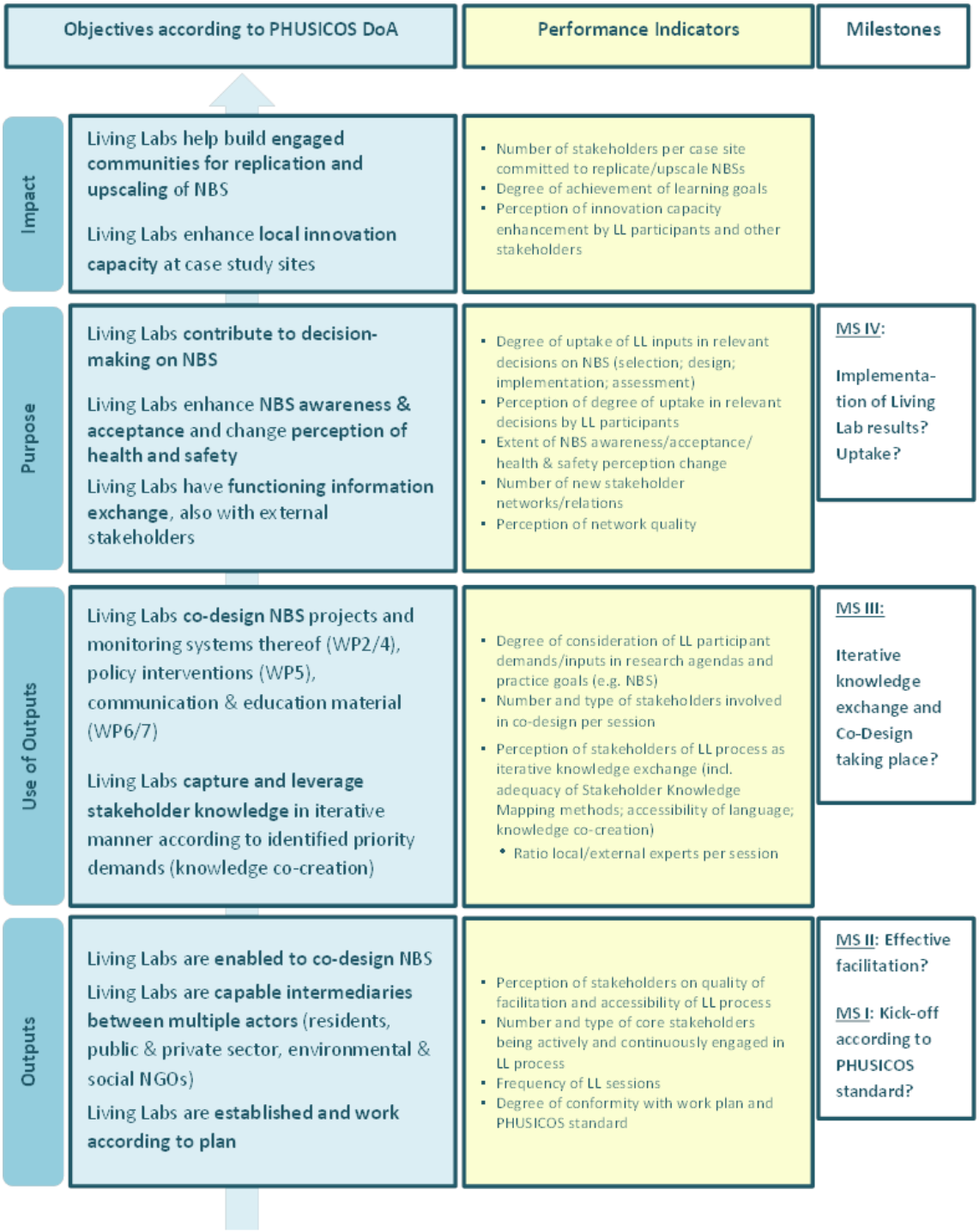

Figure 5. Targets, performance indicators and milestones for PHUSICOS Living Labs. (Milestone (MS I-IV) formulation inspired by Van der Jagt et al., 2017; Design: S. Fohlmeister 2019).

Compiling the performance indicators into the M&E matrix and operationalizing them, the M&E scheme can be presented (see Chap. 7.2, Table 15).

7.2 The M&E scheme

The M&E scheme outlined in detail in Table 15, has been conceptualized based on the following considerations (see also *Steps to design an M&E system*, Chap. 4). While D3.3 identified the contextual aspects that have to be considered establishing the M&E scheme, D4.4 put these reflections in the context of the different cases sites and WP needs. The considerations are the following:

Purpose: The M&E scheme has the purpose to assess stakeholder participation and the satisfaction with the Living Lab experience, especially regarding the quality of the Living Lab process and its outcomes. Furthermore, it aims at documenting the stakeholder knowledge evolution.

Scope: The M&E implemented needs to balance between practicality for a broad spectrum of stakeholder types, and efficiency delivering a maximum amount of relevant information despite a limited resources and time available.

Stakeholder involvement: Due to the importance of stakeholder involvement in PHUSICOS, a participatory approach to M&E is recommended (see also Chap. 4.1). Local stakeholders should be given the opportunity to express their expectations on what is a *successful* Living Lab process to them, and also to discuss the set of criteria. Moreover, the Living Lab participants should have an active part in the M&E process by being the addressees of regular surveys and contribute their insights to the lesson learned workshops which are foreseen for the final project period.

Data demands, collection/analysis procedures & storage: An indicator-based approach (see Chap. 5.1) is suggested as it offers a systematic procedure that can also be adapted to individual needs. Quantitative and qualitative data need to be collected for the different indicators in surveys and supplemented by interviews of key stakeholders at certain points in time. Table 15 provides a suggestion when to collect data and information for the different indicators. The extent and content of additional interviews e.g. for reflections on indicators or lessons learned and their respective methodology (e.g. semi-structured protocol interviews or formats like workshops) will be defined after the sites and stakeholders have collected some experiences with the Living Lab processes.

While the local facilitators will be in charge of the data collection and translation of materials such as interview sheets for the participants to the local languages, WP3 will be responsible for data analysis and support the local sites to develop corrective actions (e.g. adjusted workplans) if needed. Data collection and processing will follow the data management guidelines provided by WP1 to all partners to ensure that data are dealt with accordingly, including sensitive data. Data exchange will take place via secure internal platforms of PHUSICOS, anticipating that the appropriate confidentiality can be assured.

Contextual factors: The demonstrator and concept case sites will have to consider their local contexts, especially regarding potential risks which might influence the success of realizing their Living Labs. Factors such as pre-existing conflicts, institutional, communication or management structures need to be identified and reported during the

M&E process. A systematic stakeholder identification and analysis is meaningful for this purpose.

Building on these *corner stones* of the M&E scheme, in the following the **detailed design of the M&E matrix** (see Table 15) and related activities are explained.
Table 15 illustrates the most relevant elements of the M&E scheme at a glance. It comprises a total of eight columns, which inform *what, when, how, who* and *what for?* of the M&E scheme.

What?

Columns 1 to 4 detail the information of *what* is the subject of the M&E scheme. **Column 1** is about the **objective levels**, which the M&E scheme embraces. Reading the related **objectives**[9] (**Column 2**) from bottom to top, the intervention logic of the Living Lab process which is targeted in PHUSICOS can be followed.
Column 4 lists the **indicators**, which are proposed for this version of the M&E scheme to assess the progress towards the mentioned objectives by each level. These indicators (**codes** given in **column 3**) have been formulated without specifying target values for each to the current point of time, as this is a task *which calls for exchange with the facilitator teams of the case study sites as well with remaining PHUSICOS partners*. Thus, it is recommended to identify and add the respective target values to each indicator in due course, e.g. when updating this M&E scheme and preparing the next version (D3.6, *Version 3*).
Column 5 informs the **evaluation criteria** which are covered by each indicator. This builds the link to the pool of evaluation criteria investigated for this deliverable (see Chap. 6.2 & 6.3), and shows the relationship between each indicator and the criteria identified to be key for achieving an effective participatory process and Living Lab approach for NBS co-design.

How?

In **Column 6**, **methods of data collection** are indicated, which seem adequate to assess the related indicators and evaluation criteria. In **column 7**, it is differentiated between what is ***proposed*** (☑-symbol), and what ***could be additional*** methods to be applied (☒-symbol), e.g. in case more in-depth insights are desired or resources are available.
Based on the condition that M&E needs to take place as resource-efficient as possible, surveys, documentary analysis and interviews have been selected from the variety of possible data collection options (see Appendix B).

Surveys, ***in-depth interviews*** as well as ***short snapshot interviews*** and ***text analyses*** are conducted to evaluate the different type of Living Lab sessions with a variety of formats, which captures participant satisfaction regarding NBS awareness, perception and their changes throughout the Living Lab processes. They assess satisfaction with the events, their content, the progress of the Living Lab processes and their outcomes. Survey materials for the M&E activities have been developed, evolved and adapted to the local context in an iterative way. The materials serve to assess larger events from both the stakeholders' (Appendix D) as well as from the facilitator's (Appendix E) perspective. The evaluation of a Living Lab session from stakeholders' perspectives (Appendix D)

[9] The objectives have been identified and formulated according to the Document of Action (DoA), Part A - Work Package 3 description.

and the facilitator's perspective (Appendix E) should be conducted after each longer (more than three hours), larger Living Lab meeting or workshop (eight or more participants), while interviews related to more general aspects or capturing stakeholder knowledge (Appendix G) can be conducted less frequently and also independently from a meeting or session at certain points of time (early stage, halfway and at the end of the Living Lab process).

Interviews can be both semi-structured interviews and structured interviews, and are understood as a tool for gaining more in-depth insight into causal relationships, providing the basis for standardized surveys and for capturing in-depth qualitative information.

Document analysis includes all kinds of desktop studies of documents, such as Living Lab session protocols, policy papers or meeting documents. It is a useful method to extract information for both local facilitators as well as for WP3 to support and collect information.

When?

Column 8 informs the proposed **frequency** of undertaking M&E activities. Here, a differentiation is made by using three variants of the ◇◈◆-symbol. While the ◆-symbol indicates an assessment being recommended to be done with a ***higher frequency***, e.g. by each Living Lab session, the ◈-symbol represents a ***bi-annual frequency***. The ◇-symbol stands for an ***annual frequency or less frequent assessment***, e.g. using occasions such as the midterm performance assessment (2020) or final assessment (2022) of Living Labs. If two symbols are displayed together, e.g. ◈◆, it means that a bi-annual frequency of the related M&E activity is proposed, however, a more often frequency could be chosen by local facilitators if preferred to. For example, this is the case for the number of Living Lab sessions. While the DoA states the number of two Living Lab sessions per case site per year as a minimum demand, all case sites should feel free to foster a more often get-together of their Living Labs.

Who?

Column 9 informs the **responsibilities** for the M&E activities. As outlined in Chapter 1.1 (Fig. 2), the M&E scheme is based on a partnership approach, distributing the responsibility for its use between the case study sites and Work Package 3. The responsibility for ***data collection and synthesis*** (DC+S) should lie in the hands of the local facilitators of the demonstrator and concept case study sites, while the WP3 team is intended to carry out the ***data analysis*** (DA) and formulation of corrective action, if needed to improve stakeholder involvement.

What For?

To conclude, **Column 10** indicates the **focus of what the collected data is used** for. Three variants of this focus are differentiated, namely *Living Lab quality monitoring*, *User satisfaction* and *Impact reporting PHUSICOS*. If data contributes mostly to ***Living Lab quality monitoring***, insights will be gained on to what extent the Living Lab process is managed according to PHUSICOS quality standards and whether it can be regarded an effective participatory process (see Chap. 6). Another part of the M&E data will be

more relevant to formulate insights on the ***User satisfaction*** of the involved stakeholders. Finally, M&E data might also have the focus to contribute to *the* ***Impact reporting of PHUSICOS***. This is especially the case for data on anticipated outcomes on higher objective levels, such as the uptake of Living Lab participants' priority demands, the perception of the innovation capacity and potential changes in NBS awareness and acceptance (see also Chap. 7.1, Table 13).

Table 15. Proposed M&E Matrix (Version 1) to assess stakeholder participation and user satisfaction with Living Lab experience in PHUSICOS (Concept & design: S. Fohlmeister 2019)

Column 1	*Column 2*	*Column 3*	*Column 4*	*Colum 5*	*Column 6*	*Column 7*			*Column 8*	*Column 9*		*Column 10*
Level of Objective	**Objectives according to Document of Action (DoA)**	**Indicator Code**	**Proposed Indicators** **Average target values for the indicators defined together with all local case study sites.*	**Evaluation Criteria covered**	**Data source of verification & Proposed Tool for Data Collection**	**Methods of Data Collection** **☑ = proposed ☒ = potential / additional**			**Proposed Frequency** ◇ annually or less frequent ◈ bi-annually ◈ higher frequency	**Responsibility** **(DC+S = Data collection and synthesis)** **(DA = Data analysis)**		**Focus of Data use**
						Survey	**Document analysis**	**Interview**		**Case Sites**	**WP3**	
Overall objective (Impact)	Living Labs help build **engaged communities for replication and upscaling** of NBS	**I.16**	Number of stakeholders per case site committed to replicate/upscale NBS	Capacity building, Social capital, Institutional capital, Ownership	Living Lab session protocols; Living Lab Participant Survey Templates D/E/G	☑	◇		◇	**DC+S**	**DA**	Impact reporting PHUSICOS
	Living Labs enhance **local innovation capacity** at case study sites	**I.15**	Degree of achievement of learning goals	Learning, Innovation, Capacity building	Living Lab session protocols; Living Lab Participant Survey Templates D/E/G	☑	◇	☒	◇	**DC+S**	**DA**	Impact reporting PHUSICOS
		I.14	Perception of innovation capacity enhancement by LL participants and other stakeholders	Learning, Innovation, Capacity building, Empowerment of innovators	Living Lab Participant Survey; Interviews with other stakeholders Templates D/E/G	☑	◇	☒	◇	**DC+S**	**DA**	Impact reporting PHUSICOS
Purpose (Outcome)	Living Labs **contribute to decision-making on NBS**	**I.13**	Degree of uptake of LL inputs in relevant decisions on NBS (selection; design; implementation; assessment)	Participants' power to influence, Participants' impact on outcomes	Living Lab Participant Survey; Policy Paper Analysis (e.g. Env. Prot.) Templates D/E/G	(☑)	◇		◇	**DC+S**	**DA**	Impact reporting PHUSICOS
		I.12	Perception of degree of uptake in relevant decisions by LL participants	Participants' power to influence, Participants' impact on outcomes	Living Lab Participant Survey Templates D/E/G	☑	◇	☒	◇	**DC+S**	**DA**	Impact reporting PHUSICOS
	Living Labs enhance **NBS awareness & acceptance** and change **perception of health and safety**	**I.11**	Extent of NBS awareness/acceptance/ health & safety perception change	Learning, Capacity building, Social capital, Institutional capital	Living Lab Participant Survey Template G	☑	◇	☒	◇	**DC+S**	**DA**	Impact reporting PHUSICOS
	Living Labs have **functioning information exchange**, also with external stakeholders	**I.10**	Number of new stakeholder networks/relations	Social capital, Institutional capital	Living Lab session protocols; Living Lab Participant Survey Template D/E/G	☑	◇		◇	**DC+S**	**DA**	LL quality monitoring
		I.9	Perception of network quality	Social capital, Institutional capital	Living Lab Participant Survey Template D/E/G	☑	◇	☒	◇	**DC+S**	**DA**	User satisfaction
Use of Outputs	Living Labs **co-design NBS** projects and other PHUSICOS products (WP2/4/5/6/7)	**I.8**	Degree of consideration of LL participant demands/inputs in research agendas of WPs and practice-related goals (e.g. NBSs)	Participants' power to influence, Participants' impact on outcomes, Integration of local and scientific knowledge	Living Lab session protocols; Living Lab Participant Survey Template D/E/G	☑	◈		◈	**DC+S**	**DA**	User satisfaction
		I.7	Number and type of stakeholders involved in co-design per session	Representativeness, Legitimacy, Participants' power to influence	Living Lab session protocols; Living Lab Participant Survey Template D/E	☑	◇◈		◇◈	**DC+S**	**DA**	LL quality monitoring
	Living Labs **capture and leverage stakeholder knowledge** in iterative manner according to identified priority demands	**I.6**	Perception of stakeholders of LL process as iterative knowledge exchange (incl. adequacy of participatory methods; accessibility of language; knowledge co-creation)	Integration of local and scientific knowledge, Suitable methods, Continuous and active involvement, Provision of learning opportunities	Living Lab Participant Survey Template D/E	☑	◇◈	☒	◇◈	**DC+S**	**DA**	User satisfaction
		I.5	Ratio local/external experts per session	Integration of local and scientific knowledge, Learning	Living Lab session protocols; Living Lab Participant Survey Template D/E	☑	◇◈		◇◈	**DC+S**	**DA**	LL quality monitoring
Outputs	Living Labs are **enabled to co-design** NBS	**I.4**	Perception of stakeholders on quality of facilitation and accessibility of LL process	Highly-skilled facilitation of process, Transparency, Resource accessibility and availability	Living Lab Participant Survey, Template D/E	☑	◇◈		◇◈	**DC+S**	**DA**	LL quality m. / User satisfaction
	Living Labs are **capable intermediaries between multiple actors** (public & private sector, env. & social NGOs, citizens)	**I.3**	Number and type of core stakeholders being actively and continuously engaged in LL process	Representativeness, Transparency, Legitimacy, highly-skilled facilitation of process, Suitable methods, continuous and active involvement	Living Lab session protocols; Living Lab Participant Survey Template D/E	☑	◇◈		◇◈	**DC+S**	**DA**	LL quality monitoring
	Living Labs are **established and work according to plan**	**I.2**	Frequency of LL sessions	Continuous and active involvement	Work plan Living Lab session protocols; Living Lab Participant Survey Template D, F		◈		◈	**DC+S**	**DA**	LL quality monitoring
		I.1	Degree of conformity with work plan and PHUSICOS standard	Transparency, Legitimacy, Cost-benefit ratio, Structured participatory process	Living Lab session protocols; Work plan Template E, F		◈		◈	**DC+S**	**DA**	LL quality monitoring

7.3 What matters to us (II)? Operationalizing the M&E scheme and tailoring it to case-site specific needs

The operationalization of the M&E is based on the suggestions in the previous chapter to implement an indicator driven approach. Reflecting the suggested indicators given in table 15, the M&E operationalization procedure is based on three different strands (Figure 6) interacting with each other:

- Strand 1: Living Lab strategies determine the goals and targets of the Living Lab process and related annual roadmaps to formulate sub-goals to be achieved in the next year;
- Strand 2: assessment of Living Lab performance by capturing user satisfaction with the process; and
- Strand 3: map the evolution of stakeholder knowledge and perception on NBS throughout the PHUSICOS project and its Living Lab processes.

Templates for these different strands were developed to standardize and simplify the procedures and operationalizing the given set of indicators by interview questions where possible.

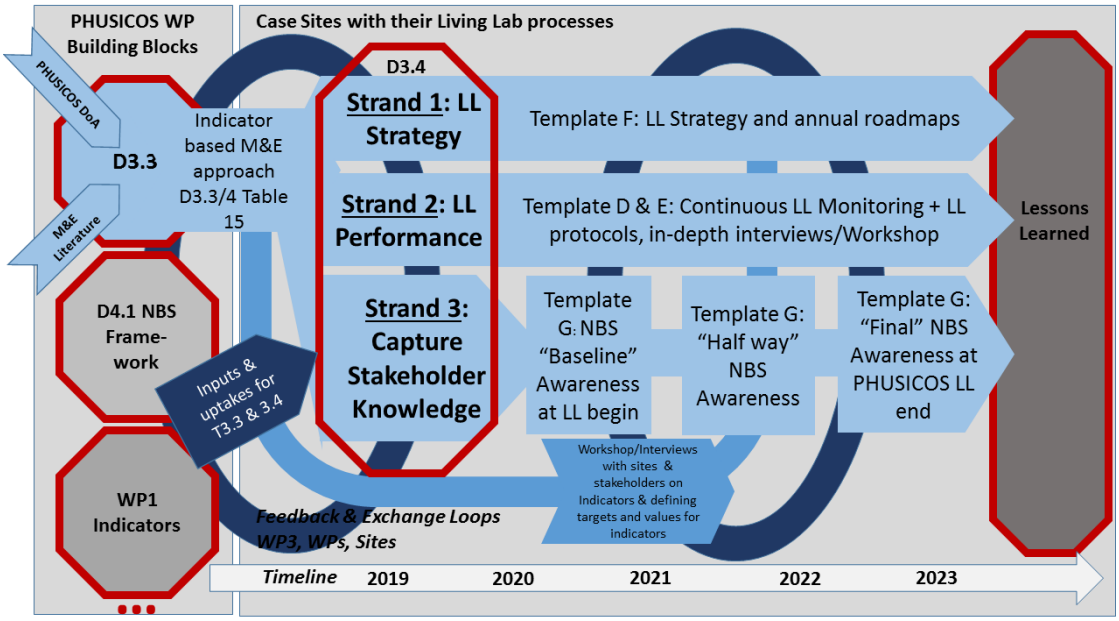

Figure 6: Operationalization of the M&E Scheme into practice, role and function of the different templates

Templates D and E collect the information on M&E of the living lab processes and the satisfaction with the processes. Template D captures the stakeholders' perspective of living lab sessions and their facilitation. Indicators from table 15 are operationalized through questions in a survey interview sheet. Template E addresses site owners' and facilitators' views on the Living Lab sessions. Both templates should be used after each living lab session to monitor, evaluate and follow the respective processes closely.

Templates F support the development of a strategy paper at the beginning of the living lab process, ideally picking up, reflecting and referring to the set of indicators given in table 15 to define targets of the Living Lab process. With annual roadmaps, more detailed goals to be achieved for the upcoming year are formulated.

Templates G intend to collect information on stakeholder knowledge based on the set of indicators from table 15, but also pick up elements from other work packages that are important building blocks of the Living Lab processes (see Figure 2). To describe the development of stakeholder knowledge and perception of NBSs as solutions to reduce risks from natural hazards, interview questions in Templates G are asked towards the beginning, middle and end of the Living Lab processes to draw upon the lessons learned. The standardized interview sheets can be filled out during a Living Lab session, or stakeholders are contacted independent from a session to answer the questions online. In-depth guided interviews with selected stakeholders can be conducted on an individual basis by contacting the selected persons. Similar to the standardized surveys, in-depth interviews with the selected persons are conducted towards the beginning, middle and end of the end of the project.

To operationalise the M&E scheme and tailor it to the case study sites, the following continuous strands are thus needed:

i. Strand 1: Develop a Living Lab strategy and determine goals
ii. Strand 2: Adapting and operationalizing the M&E scheme for the case site needs
iii. Strand 3: Capture stakeholder knowledge

After the case sites and stakeholders collected first experiences with the Living Lab process and gaining an understanding of stakeholder knowledge, the M&E scheme can be validated. In this procedure, additional indicators can be added and potential missing target values can be defined.

7.3.1 Strand 1: Development of Living Lab strategies and determine goals

A key element of the M&E process is developing a Living Lab strategy that considers the set of indicators. Local facilitator teams define the intended focus and scope of co-design, approaches, how to identify and document the Living Lab participants' priority demands and also learning goals. A strategy paper should be developed by site owners and facilitators for this purpose. Making use of the appendix F template section F1, sites describe their intended Living Lab actions for the project lifetime and key goals of a Living Lab processes to be achieved and targets met. Also, other aspects such as key topics and priorities for the Living Labs can be formulated. A work plan or shorter annual roadmaps can serve as basis to track the Living Labs' effectiveness.

For complex processes or to better track processes and steps to be achieved, the overall strategy description for the different demonstrator and concept cases can be cut down into annual roadmaps (appendix F, section F2) with more specific goals, strategies, detailed work plans and actions as well as sub-goals for a more foreseeable annual time frame. This is especially important when stakeholder engagement strategies have to be adjusted due to case-related or external impacts and obstacles (e.g., technical issues, or restrictions due to the SARS-CoV-2 pandemic limiting possible formats for stakeholder engagement processes). Annual roadmaps can also be useful for case sites that intend to initiate more than one Living Lab process e.g. to develop several NBSs in in different locations. At case sites with different NBSs and related Living Lab processes, a strategy paper and annual roadmaps can define and track goals to be achieved for each of the processes can be more feasible than overall, long-term strategies.

Listening to and understanding stakeholders is considered one of the most critical parts of participatory processes (Murray-Webster & Simon, 2006). The identification of stakeholder roles can help to better understand stakeholder behaviours and decisions in Living Labs. At the beginning of the Living Lab process, a systematic stakeholder mapping exercise is useful to identify relevant participants (Fohlmeister et al., 2019).

Such a mapping task aims to achieve the involvement of a broad spectrum of stakeholders not only in the planning stage, but also in the design, implementation, monitoring, and evaluation as well as the maintenance stages of projects. Reviewing the mapping to have all potential stakeholders onboard should be repeated several times throughout the lifetime of a Living Lab process as new stakeholders might become relevant in an evolving context.

For PHUSICOS, a methodology developed from the sister project RECONECT (Hüesker et al., 2018; Zingraff-Hamed et al., 2020) was applied for this purpose[10]. First, potential stakeholders are listed based on available information from the different sites with the aid of relevant documentation, including support letters and available protocols from stakeholder meetings at different sites. For this purpose, structured worksheets developed by RECONECT serve as a template to collect information on the PHUSICOS cases (Appendix H). Site owners and facilitators filled in the worksheets using the prepared list of stakeholder groups, added new potential stakeholders and characterized them according to the template. Afterwards, WP3 contacted each site owner and facilitator to validate the results.

Stakeholders were characterized according to five criteria:

- **Belonging:** this variable describes the case study site the stakeholder belongs to, their institution, as well as which stakeholder group the stakeholder represents. Stakeholder groups represent different sectors: governmental authorities, political representatives, civil society, private sector, academia and research,

[10] Detailed methodological descriptions on the stakeholder mapping can be found in these two publications. The methodology was chosen to allow cross-case comparison and validity of the RECONECT method. The following sections follow Zingraff-Hamed et al. (2020)

media, and international and transnational organizations. Each stakeholder was assigned to only the most relevant sector for the Living Lab.

- **Role of stakeholders:** Each stakeholder can have different roles. For example, the decision-makers execute decisions. The implementers are responsible for the execution or implementation. The facilitators coordinate a variety of actors for the design, implementation, and monitoring of measures. The providers of expert knowledge are mostly consultants, universities, insurance companies, as well as local informants from civil society. The funders or sponsors can be private, governmental, or non-governmental, and finance activities and measures. The lobbyists refer to stakeholders or group representatives who attempt to influence decision-making. The mediators or facilitators mediate and facilitate communication between different stakeholders.
- **Planning stage:** this criterion describes the steps of the NBS project. The importance of various actors can vary during the different phases of designing, planning, implementation, monitoring, evaluating and maintaining an NBS. Even when striving for broad regular involvement during all phases according to the Living Lab definition (Fohlmeister et al., 2018), this evaluation helps to determine the participants' varying levels of motivation to participate at different levels. It also provides a better understanding of the stakeholders´ relative power, influence, and interests throughout the steps of a co-creation process.
- **Relationship to the hazards:** This category looks at the relationship of stakeholders to natural hazards and NBSs. It estimates whether the actor is directly or only indirectly affected by natural hazards or has the influence on natural hazards. For example, property owners can be threatened by floods (Murray-Webster and Simon, 2006). On the other hand, some stakeholders have the ability to reduce or mitigate natural hazards (e.g., forest owners with their forest management strategy).
- **Relation to the NBS:** This category has two elements. The first element is the level of benefit. While some stakeholders might be benefitting from a measure, this might not be the case for others (a farmer might lose income when highly productive farmland is restored to wetlands for water retention to reduce the risk of flooding downstream).
  The second element determines the ability of different stakeholders to influence the decision on potential NBS or traditional grey engineering solutions. Furthermore, some stakeholders might not have the power to influence all of the phases but might be influential in the implementation phase by intervening or even stopping the implementation of NBS.

For further understanding, the criteria were analysed using descriptive statistical methods on qualitative variables to cluster stakeholders according to their belonging. Five core types of stakeholders could be identified: "stakeholders in charge", "wise and active stakeholders", "affected silent stakeholders", the "officials moderately concerned" and the "observers."

"Observers" are the least affected by the hazards, the least affecting the hazards, the least affecting the solution and the least affected by the solution. They are usually

academia, media and stakeholders from international and transnational organizations as well as authorities.

"Officials moderately concerned" are mostly authorities or political representatives. Their main characteristics are that they are moderately affected by the hazards as well as by the solution and usually, they are not part of the design or maintenance.

"Affected silent stakeholders" are mostly from civil society or from the private sector and are the ones the most affected by the hazards and/or the solutions. They are rarely involved in traditional planning processes, but often their help or support is required for the implementation.

"Wise and active stakeholders" are also usually a small group and provide knowledge. For this reason, they are involved in all phases of the planning process. They are moderately affecting the hazard but the most affected by the NBS. They are often part of civil society and are likely to be lobbyists for environmental protection.

"Stakeholders in charge" are mostly authorities and are affecting the hazards as well as the NBS solution. They are coordinators, implementers and funders, and ultimately, decision makers.

This resulting classification creates a systematic knowledge basis of the stakeholders in the Living Lab processes as a key element for successful collaborative work (Brugha & Varvasovszky, 2000). It helps to avoid pitfalls or failures due to problems with stakeholder representation or composition, identifies the most affecting and effected stakeholders to be able to identify attitudes and views in contested terrain (Reed & Curzon, 2015) and also draws attention to giving the silent affected stakeholders a voice. It can therefore support Living Lab facilitators with better understanding and management of their stakeholder processes and interactions, interest, power and their manifestations in a project (Rist et al., 2007).

Depending on the co-design strategies (e.g., engaging a core group of stakeholders at certain phases or having a broader inclusive approach), the conducted stakeholder mapping helps to determine the actors for the different NBS phases. If the facilitation strives for a continuous involvement of all actors, the mapping helps to understand varying interests throughout the co-planning, co-design and co-implementation phase and allows developing strategies to keep actors motivated or involved at all stages.

The advantage of the developed classification compared to other models (e.g., Murray-Webster & Simon, 2006) is that it provides a better understanding of stakeholder roles in co-designing processes and its different stages. For example, stakeholder mapping can support facilitators of such processes also to understand the power and influence of actors in the processes. It helps to add the quadruple helix concept to avoid having all four groups engaged but ending up largely with "observers" in the process potentially without the power to implement the solution. Depending on the co-design strategies, this classification supports designing work with a core group at certain phases and having a

broader inclusive approach in other phases. If processes strive for a continuous involvement of all actors, the mapping helps to understand varying interests throughout the co-planning, co-design and co-implementation phase and allows developing strategies to keep actors motivated or involved at all stages.

7.3.2 Strand 2: Test, adapt and operationalizing the M&E scheme to case site needs

An important step to operationalize the M&E scheme was testing the practical use of the suggested templates to capture the case sites' demands and to opt for more flexible approaches to adapt to the different case site situations and needs.
Testing took place in various forms. Local facilitator teams first checked if the terminology used in the provided templates (Appendices D, E) can be understood by stakeholders and made necessary alterations. Collecting data on the suggested indicators for regular evaluation on Living Lab performance in chapter 7.2, the set of questions were adapted and adjusted to ensure similar standards on data collection for regular evaluations of the Living Lab performances. A core set of questions is suggested depending on the focus of the Living Lab sessions. Additional questions related to steps taken can be included to reflect the respective focus of the session.

The resulting questionnaires were pre-tested (Bortz and Döring 1995) at the Isar case in the AmperRhei Living Lab in early summer 2019 with stakeholders. The Amper River is a tributary to the Isar River and joins the Isar north of Freising. This Living Lab process managed by the local water management office was the most active process in the Isar River basin in 2019 with frequent Living Lab sessions to discuss and work on NBSs to improve flood protection and the ecological status of the Amper River. TUM was asked for consultancy and advice for this process and invited to make use of the case to pre-test elaborated interview materials and data collection methods for PHUSICOS monitoring and evaluation procedures. The suggested set of questions from D3.3 and the set of selected questions by the PHUSICOS sites were tested first at the Amper Rhei Living Lab including the use of an online survey tool. With the positive test run at the Isar concept case, the set of selected questions were then translated to the respective languages of the project sites and adapted to the different cultural contexts of the participating countries.

Sites could opt between using traditional paper questionnaires that are coded for further processing in SPSS (Version 23) or conducted online while still ensuring high privacy and data management safety. The online tool SoSci Survey[11] (Leiner 2019) was selected for the case sites opting to make use of a digital questionnaire. The online questionnaire was prepared by WP3 together with the sites, pre-tested for functionality and potential defects with the site owners and facilitators. Participants received a hyperlink to the

[11] www.soscisurvey.de; SoSci Survey is a professional tool for online surveys. SoSci Survey is handled through the internet browser and there is no need to install software. The basis for the SoSci tool was developed at the Institute for Communication Science and Media Science at the LMU Munich in 2003. SoSci Survey is based in Munich and follows privacy regulations and respective data handling according to German law and privacy regulations.

survey during the Living Lab session and in a follow-up e-mail afterwards, with reminders sent out by the facilitators to ensure a good return rate.

For assessing the facilitators' perspectives of a Living Lab session (Appendix E), pre-testing from the AmperRhei and feedback from the case sites led to a facilitator sheet with mainly open-ended questions to reflect the past Living Lab session. This open approach was considered useful to encourage and stimulate more in-depth reflections of the facilitation team on their sessions as well as the evaluating tools used during the sessions to draw lessons learned. This way, the facilitating teams of the case sites can better develop concepts, strategies and use of different tools for their processes and meetings.

7.3.3 Strand 3: Capture stakeholder knowledge

The most relevant component identified by the PHUSICOS stakeholders are the Living Lab participants' awareness and acceptance of NBS (see Appendices G for Template). This assessment was considered most useful to detect changes regarding NBS perception, knowledge, awareness and learning processes among the stakeholders. Compared to interviews related to the Living Lab sessions chosen in Appendix D, Appendix G intends to capture a more in-depth and long-term understanding and description of the learning processes during PHUSICOS in the context of the development, promotion and co-design of solutions, as well as stakeholder commitment. Using the deliverable report D4.1 *Comprehensive Framework for NBS Assessment* (Autuori et al. 2019) as one of the building blocks of a multi-level approach for M&E, core elements such as the developed ambits were picked up and further operationalized for the interview sheet. Questions relating to potential barriers and enablers of NBS implementation were derived from D5.1 *NBS in-depth case study analysis of the characteristics of successful governance models* (Martin et al. 2019).

First, in-depth interviews (Appendix G1) were developed for collecting information from systematically selected key stakeholders identified by the stakeholder mapping task at all case study sites (see Chapter 7.3.1). To draw comparisons across sites or individual developments at each case site and to similar standards, this recruitment and selection process for interview partners was done in a coordinated way across all different case sites. A systematic stakeholder selection and approach to sample interviewees based on iterative exchange with the case sites ensured the coverage of all four groups of stakeholders involved in Living Lab processes (private sector such as businesses, citizens, academia and the public sector like administrations), as well as potentially different worldviews by choosing different sociodemographic backgrounds.

The set of questions for the in-depth interviews were elaborated, evolved and adapted together with facilitators, site owners and WP partners. The aim of this procedure was to tailor the resulting monitoring questions the different case site needs, allow case comparability and to collect more in-depth information on stakeholder awareness. The

questions were translated to the local languages where needed and interviews were conducted by the respective case site facilitator team by video meetings, telephone, or face-to-face meetings in the field depending on the restrictions in place for SARS-CoV-19.

The open-ended questions then were also asked in a larger online Living Lab session hosted by at the Serchio River basin case in 2021 using an online survey. Participants could fill in their answers.

Based on the outcome of the open-ended interviews with the selected key stakeholders and asking the set of questions at a Living Lab session by the Serchio River basin, a standardized tick-box questionnaire (Appendix G4) was developed to reach out to a broad range of stakeholders over all case sites.

Repetition of the assessment both with in-depth interviews and standardized questionnaires is intended to be conducted at later stages and at the end of the PHUSICOS project (Appendix G2 and G3). This approach will allow descriptions of the developments and evolvement of stakeholder views on NBS, acceptance, learning and their willingness to upscale, replicate or initiate new measures.

7.3.4 Validation of the M&E scheme, additional indicators and defining target values

Although the DoA is clear on what should be achieved by the Living Labs (see Chap. 7.1), the answer to the question *"What matters to us?"* might still look different from the local case sites' perspective. As the literature review showed, there are abundant criteria to define what makes a participatory process a *good* one, and what it needs to go beyond it to achieve an innovative Living Lab experience. Nevertheless, the local definition of a successful Living Lab experience might be divergent from that, and even differ between the individual PHUSICOS demonstrator and concept case sites. Therefore, the M&E scheme presented in Chap. 7.2 needs to reflects the viewpoints of both the site owners and the Living Lab participants.

As outlined in Chapters 4 & 5, involving stakeholders in the step of indicator formulation can be beneficial for various reasons; a prominent one is to foster motivation and ownership for the participatory process. In order to find out whether the M&E scheme matches the local viewpoint on what would be a *satisfying and successful* Living Lab experience, local facilitators should team up with their Living Lab participants or a small group seeming suitable for this purpose, and to validate the indicators.

Indicators should be validated in a similar format across all case study sites in a participatory process, e.g., as part of a Living Lab session or in a separate meeting. The validation process should start after participants and stakeholders have collected experiences with the Living Labs. An entry point into such a discussion could be the

question "*What would make our Living Lab a successful experience*?" In this way, additional indicators can be identified that are considered meaningful to the local case sites for their future M&E process.

At the same time or in a further step, the given indicators from table 15 and potential new ones formulated by the different sites, Living Lab processes and stakeholders need to be further specified and values or targets set for both the given and newly selected site-specific indicators.

Validation, selection of additional indicators and definitions of target values will demand similar overall Living Lab workshop elements and/or interviews formats with Living Lab participants at the different case study sites to ensure similar standards, comparability of similar processes and to draw general lessons learned. Therefore, these tasks will be completed in collaboration with the different site owners and facilitators, WP2 as coordination of both the concept and demonstrator cases, WP3 to provide guidance and support and the sites being in charge of the data collection.

8 Final remarks – Coping with the SARS-CoV-2 outbreak

This deliverable D3.6 is the final one in a series of deliverables on *Monitoring & Evaluation Scheme to Assess Stakeholder Participation and User Satisfaction with Living Lab Experience (Version 1-3).* It further elaborates previous deliverables to support the quality management of the Living Labs' co-design processes. It aims to support local facilitator teams of demonstrator and concept case sites by providing guidance to monitor, evaluate, manage and steer their Living Lab processes, incorporating their feedback and first experiences made in an iterative way.

Since the World Health Organization (WHO) declared that the SARS-CoV-2 outbreak constituted a Public Health Emergency of International Concern on January 30, 2020, numerous government measures for social distancing have been introduced to limit the transmission of the disease around the globe. As a consequence, since mid-March 2020, the world has seen closures of all non-essential public services and cancelling of public gatherings, which had a severe impact on collaborative planning approaches. At the time of finalizing this deliverable report in January 2022, it is not foreseeable when preventive measures will be eased and when in-person meetings and all collaborative formats requiring direct interactions in face-to-face settings will be possible again. Despite a shift to digital formats, for the foreseeable future, the pandemic and the uncertainty that comes with it will continue to affect Living Lab workplans, possible meetings and session formats. Ultimately, the suggested Monitoring and Evaluation procedures described in this final of the Deliverable series might need to be further elaborated and adapted to reflect the challenges related to the current pandemic. This might require flexible, new approaches elaborated in an iterative way with the site owners to cope with the volatile situation.

The suggested actions for addressing the situation are:

For the ***local Facilitator teams of the demonstrator and concept case sites:***

- Stronger focus on annual Living Lab roadmaps (see Appendix F) with short term targets and their assessment to advance and flexibly adapt to the situation while keeping the Living Labs on track and responding to the respective governmental measures;
- Assessment of Living Lab participants' NBS awareness and acceptance as input to establish a baseline (see Appendices G) by both conducting in-depth interviews with a small, selected core group of stakeholders at each site.
- Additionally, using standardized surveys and making use of digital formats (e.g., online surveys) that can be conducted independently from larger in-person meetings;
- When larger sessions are possible (e.g., in digital formats instead of physical meetings), collecting information on the performance of Living Labs for the M&E scheme and adding questions related to the respective purpose of the Living Lab session (see Appendix D); and
- To capture the activities conducted with smaller subgroups and fewer participants for M&E where standardized formats provide limited or no

substantial information, collecting sound documentation, feedback and materials for qualitative assessments is vital. Qualitative assessments (e.g., document analyses) linked to the selected set of indicators can be further valuable sources of information for the M&E.

For the ***team of Work Package 3 (WP3):***

- Continuous feedback and exchange with the case sites. This means keeping up to date on case site activities to adapt the M&E activities to the Living Lab processes accordingly. Additionally, this means considering external factors such as SARS-CoV-2 and adjusting formats for collaborative planning to adapt to the given situation;
- Collect and assess materials documenting Living Lab sessions and activities with few stakeholders, short meetings, field trips and meetings, etc. for qualitative assessments together with the site owners.

Acknowledgements

We would like to express our gratitude to all contributors to this deliverable, especially the PHUSICOS coordinating team Amy Oen, Bjørn Kalsnes and Farrokh Nadim (NGI) for the quality control and support to adequately conceptualizing this report in an iterative approach. As iteration is not possible without the target group it shall serve, we also thank the local facilitator teams of the demonstrator and concept case sites for their continued willingness to set aside time and resources for providing their feedback and insights into their realistic demands.

We also thank our WP3 team partners Anna Scolobig (University of Geneva), JoAnne Linnerooth-Bayer, Wei Liu and Juliette Martin (all IIASA) for being partners of this Work Package in the real sense, providing valuable inputs whenever needed and meaningful, and sharing a core interest in making the Living Lab processes of demonstrator and concept case sites a reality.
Further thanks go to Alexander Van der Jagt (Utrecht University) for having shared his experiences and knowledge on M&E of Learning Alliances in the GREENSURGE context already for D 3.1, which has been a fruitful contribution also to this report.
Moreover, our appreciation is extended to Christian Smida for inspiring thoughts concerning what matters in M&E of stakeholder participation in the field, and for having done his final touch on the graphical design of this deliverable again.

We are also grateful for the professional, continuous support and supervision by our head of the chair, Stephan Pauleit (TUM).

As a final remark, the lead author of this deliverable would like to express her compliments and gratefulness to her co-author Malin Tiebel (Master's Program Sustainable Resource Management at TUM) for her excellent performance in elaborating and contributing the theoretical background section to this deliverable, and enabling us to harvest the comprehensive pool of evaluation criteria for assessing stakeholder participation from her master's thesis research work. Malin furthermore had an active part in designing the M&E templates and assessment sheets being available in the Appendix of this deliverable.

In this context, we would especially like to thank the co-author and colleague Dr. Isabel Augenstein (TUM) for her careful supervision of the related thesis, professional technical backstopping of the deliverable's methodology and continued availability for decisive and fruitful reflections.

References

Abelson, J., Gauvin, F.-P., 2006. Assessing the Impacts of Public Participation: Concepts, Evidence, and Policy Implications. Canadian Policy Research Network Inc., 42 pp. http://www.ipea.gov.br/participacao/images/pdfs/abelson%20and%20gauvin_assessing%20pp%20impacts_2006.pdf. Accessed 20 December 2018.

Annecke, W., 2008. Monitoring and evaluation of energy for development: The good, the bad and the questionable in M&E practice. Energy Policy 36 (8), 2839–2845. 10.1016/j.enpol.2008.02.043.

Appel, E., 2002. Konzeption und Durchführung von Projekten der nachhaltigen Regionalentwicklung: Projektevaluierung zur Ermittlung und Darstellung wesentlicher Faktoren bei der Umsetzung regionaler Entwicklungsinitiativen. Dissertation, Berlin.

Arbter, K., 2011. Praxisleitfaden: Standards der Öffentlichkeitsarbeit, Wien, 148 pp. https://www.netzwerk-buergerbeteiligung.de/fileadmin/Inhalte/PDF-Dokumente/Qualita%CC%88tskriterien/standards_beteiligung_oesterreich_leitf_2011.pdf. Accessed 5 January 2019.

Australian Government, 2013. Cabinet Implementation Unit Toolkit: Monitoring, review and evaluation. Cabinet Implementation Unit, Canberra, 6 pp. https://www.pmc.gov.au/sites/default/files/files/pmc/implementation-toolkit-5-monitoring.pdf. Accessed 10 January 2019.

Austrian Development Agency, 2008. Leitfaden für Projekt- und Programmevaluierungen, Wien, 45 pp. https://www.oecd.org/development/evaluation/dcdndep/43183447.pdf. Accessed 7 December 2018.

Autuori, S., Caroppi, G., De Paola, F., Giugni, M., Pugliese, F., Stanganelli, M., Urciuoli, G., 2019. Comprehensive Framework for NBS Assessment - Work Package 4 – Technical Innovation to Design a Comprehensive Framework, 58 pp., https://phusicos.eu/wp-content/uploads/2019/05/D4.1_Task4.1_UNINA_14052019_Final_withAppendicies.pdf. Accessed 6 April 2020

Beierle, T.C., 1999. Using Social Goals to Evaluate Public Participation in Environmental Decisions. Review of Policy Research 16 (3-4), 75–103. 10.1111/j.1541-1338.1999.tb00879.x.

Beywl, W., 2008. Standards für Evaluation, 4th ed. DeGEval, Köln, 51 pp.

Biancalani, R., Brown, D., DeWit, P., Clementi, S., Ljuša, M., 2004. Participatory Land Use Development in the Municipalities of Bosnia and Herzegovina: Guidelines, 67 pp.

Blackstock, K.L., Kelly, G.J., Horsey, B.L., 2007. Developing and applying a framework to evaluate participatory research for sustainability. Ecological Economics 60 (4), 726–742. 10.1016/j.ecolecon.2006.05.014.

Blahna, D.J., Yonts-Shepard, S., 1989. Public involvement in resource planning: Toward bridging the gap between policy and implementation. Society & Natural Resources 2 (1), 209–227. 10.1080/08941928909380686.

Bohnet, I.C., 2010. Integrating social and ecological knowledge for planning sustainable land- and sea-scapes: experiences from the Great Barrier Reef region, Australia. Landscape Ecology 25 (8), 1201–1218. 10.1007/s10980-010-9504-z.

Borner, J., Kraft, A.H., 2018. Konzeptpapier zum Reallabor-Ansatz, 18 pp. http://komob.de/wp-content/uploads/2018/08/ENavi_Reallabore_Borner-Kraft.pdf. Accessed 16 April 2019.

Bortz, J., Döring, N., 1995. Forschungsmethoden und Evaluation, 2. Auflage. De Gruyter,

Berlin, Heidelberg, New York, 768 S

Bours, D., 2014. From S.M.A.R.T indicators to CREAM and SPICED. https://www.linkedin.com/pulse/20141031111752-18927814-from-s-m-a-r-t-indicators-to-cream-and-spiced. Accessed 12 March 2019.

Britt, H., Hummelbrunner, R., Greene, J., 2017. Causal Link Monitoring, 37 pp. https://www.betterevaluation.org/sites/default/files/CLM%20Brief_20170615_1528%20FINAL.pdf. Accessed 30 March 2019.

Brugha, R., Varvasovszky, Z. 2000. Stakeholder analysis: A review. Health policy and Planning 15(3), pp. 239-246.

Campbell, S.v., McCormack, S., 2008. a guide for training public dialogue facilitators, Hartfort, CT, 101 pp. https://www.everyday-democracy.org/sites/default/files/attachments/Guide-Training-Public-Dialogue-Facilitators_Everyday-Democracy.pdf. Accessed 15 April 2019.

Carr, G., Blöschl, G., Loucks, D.P., 2012. Evaluating participation in water resource management: A review. Water Resources Research 48 (11). 10.1029/2011WR011662.

CDIE, 1998. Performance Monitoring and Evaluation: Guidelines for Indicator and Data Quality. TIPS 12. USAID Center for Development Information and Evaluation, 12 pp. https://www.who.int/management/district/monitoring_evaluation/GuidelinesIndicatorDataQuality.pdf. Accessed 5 April 2019.

Charnley, S., Engelbert, B., 2005. Evaluating public participation in environmental decision-making: EPA`s superfund community involvement program. Journal of environmental management 77 (3), 165–182. 10.1016/j.jenvman.2005.04.002.

Chess, C., Purcell, K., 1999. Public Participation and the Environment: Do We Know What Works? Environmental Science & Technology 33 (16), 2685–2692. 10.1021/es980500g.

Christiansen, L., Schaer, C., Larsen, C., Naswa, P., 2016. Monitoring & Evaluation for climate change adaptation: A summary of key challenges and emerging practice: Understanding, discussing and exemplifying the key challenges of M&E for adaptation, 18 pp. http://orbit.dtu.dk/files/157400902/MandE_challenge_guidance_note_01_07_16.pdf. Accessed 8 April 2019.

CIToolkit, n. Y. Traffic Light Assessment. Continuous Improvement Toolkit. https://citoolkit.com/articles/traffic-light-assessment/. Accessed 7 April 2019.

Coglianese, C., 2002. Is Satisfaction Success? Evaluating Public Participation in Regulatory Policymaking. Faculty Reseach Working Papers Series, Cambridge, Massachusetts, 27 pp.

Cohen-Shacham, E., Walters, G., Janzen, C., Maginnis, S., 2016. Nature-based solutions to address global societal challenges, Gland, Switzerland, 97 pp. https://portals.iucn.org/library/sites/library/files/documents/2016-036.pdf. Accessed 23 February 2019.

Coleman, G., 1987. Logical framework approach to the monitoring and evaluation of agricultural and rural development projects. Project Appraisal 2 (4), 251–259. 10.1080/02688867.1987.9726638.

Crawford, P., Bryce, P., 2003. Project monitoring and evaluation: a method for enhancing the efficiency and effectiveness of aid project implementation. International Journal of Project Management 21 (5), 363–373. 10.1016/S0263-7863(02)00060-1.

Dart, J., Dysdale, G., Cole, D., Saddington, M., 2000. The Most Significant Change approach for monitoring an Australian Extension project. PLA Notes 38, 47–53.

Davies, C., Hansen, R., Rall, E., Pauleit, S., Lafortezza, R., Bellis, Y. de, Santos, A., Tosics, I., 2015. Green Infrastructure Planning and Implementation: The status of European green space planning and implementation based on an analysis of selected European city-regions, 134 pp. https://greensurge.eu/working-packages/wp5/files/Green_Infrastructure_Planning_and_Implementation.pdf. Accessed 10 January 2019.

Davies, R., Dart, J., 2005. The "Most Significant Change" (MSC) Technique: A Guide to Its Use, 104 pp. https://www.mande.co.uk/wp-content/uploads/2005/MSCGuide.pdf. Accessed 20 February 2019.

DEFRA, 2013. Sustainable Development Indicators. Department for Environment Food & Rural Affairs, 100 pp. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/223992/0_SDIs_final__2_.pdf. Accessed 7 April 2019.

Directorate-General Communication, 2018. Special Eurobarometer 444: Citizens' view on nature-based solutions. https://data.europa.eu/euodp/data/dataset/S2081_84_4_444_ENG. Accessed 15 April 2019.

Dofel, S., 2010. Most Significant Change (MSC), in: Oberndörfer, D., Hanf, T., Weiland, H. (Eds.), Verfahren der Wirkungsanalyse. Ein Handbuch für die entwicklungspolitische Praxis. Arnold Bergstraesser Institut, Freiburg i. Br.

Dyer, J., Stringer, L.C., Dougill, A.J., Leventon, J., Nshimbi, M., Chama, F., Kafwifwi, A., Muledi, J.I., Kaumbu, J.-M.K., Falcao, M., Muhorro, S., Munyemba, F., Kalaba, G.M., Syampungani, S., 2014. Assessing participatory practices in community-based natural resource management: experiences in community engagement from southern Africa. Journal of environmental management 137, 137–145. 10.1016/j.jenvman.2013.11.057.

Earl, S., Carden, F., Patton, M.Q., Smutylo, T., 2001. Outcome mapping: Building learning and reflection into development programs. International Development Research Centre, Ottawa, Ont, 139 pp.

Echternacht, L., Geibler, J. von, Stadler, K., Behrend, J., Meurer, J., 2016. Methoden im Living Lab: Unterstützung der Nutzerintegration in offenen Innovationsprozessen (Entwurf Methodenhandbuch): Arbeitspapier im Arbeitspaket 2 (AS 2.2) im INNOLAB Projekt: „Living Labs in der Green Economy: Realweltliche Innovationsräume für Nutzerintegration und Nachhaltigkeit". Wuppertal Institut für Klima, Umwelt, Energie GmbH, Wuppertal, 93 pp. https://www.innolab-livinglabs.de/fileadmin/user_upload/Benutzerdaten/Publikationen/INNOLAB_AP22_WI_Methoden_imLivingLab_Juni2016.pdf. Accessed 14 February 2019.

Eckart, J., Ley, A., Häußler, E., Erl, T., 2018. Leitfragen für die Gestaltung von Partizipationsprozessen in Reallaboren, in: Defila, R., Di Giulio, A. (Eds.), Transdisziplinär und transformativ forschen. Eine Methodensammlung. Springer VS, Wiesbaden, Germany.

Eggermont, H., Balian, E., Azevedo, J.M.N., Beumer, V., Brodin, T., Claudet, J., Fady, B., Grube, M., Keune, H., Lamarque, P., Reuter, K., Smith, M., van Ham, C., Weisser, W.W., Le Roux, X., 2015. Nature-based Solutions: New Influence for Environmental Management and Research in Europe. GAIA - Ecological Perspectives for Science and Society 24 (4), 243–248. 10.14512/gaia.24.4.9.

ESF, 2014. ESF Evaluation Services. European Science Foundation. http://archives.esf.org/fileadmin/Public_documents/Publications/evaluation.pdf. Accessed 23 February 2019.

Estrella, M., Blauert, J., Campilan, D., Gaventa, J., Gonsalves, J., Guijt, I., Johnsin, D., Ricafort, R., 2000. Learning from change: Issues and experiences in participatory monitoring and evaluation. Intermediate Technologies Publications; International Development Research Centre, London, Ottawa, XIV, 274.

European Commission, 1998. CONVENTION ON ACCESS TO INFORMATION, PUBLIC PARTICIPATION IN DECISION-MAKING AND ACCESS TO JUSTICE IN ENVIRONMENTAL MATTERS.

European Commission, 2004. Project Cycle Management Guidelines, Brussels, 149 pp. https://ec.europa.eu/europeaid/sites/devco/files/methodology-aid-delivery-methods-project-cycle-management-200403_en_2.pdf. Accessed 10 January 2019.

European Commission, 2015. Towards an EU research and innovation policy agenda for nature-based solutions & re-naturing cities: Final report of the Horizon 2020 expert group on 'Nature-based solutions and re-naturing cities'. Publications Office of the European Union, Brussels, 71 pp.

Faehnle, M., Tyrväinen, L., 2013. A framework for evaluating and designing collaborative planning. Land Use Policy 34, 332–341. 10.1016/j.landusepol.2013.04.006.

FAO – Food and Agriculture Organization of the United Nations, 1995. Water sector policy review and strategy formulation. A general framework. FAO Land and Water Bulletin 3, World Bank UNDP, Rome.

Faulkner, W.N., Nkwake, A.N., 2017. The potential of Social Network Analysis as a tool for monitoring and evaluation of capacity building interventions. Journal of Gender, Agriculture and Food Security 2 (1), 125–148. 10.19268/JGAFS.212017.7.

Fayers, P.M., Machin, D., 2007. Quality of life: The assessment, analysis and interpretation of patient-reported outcomes, 2nd ed. John Wiley & Sons Ltd, Chichester, England, Hoboken, NJ, 544 pp.

Fohlmeister, S., Augenstein, I., Jones, C., Ramirez, D., Lupp, G., 2019. Starter Toolbox for Stakeholder Knowledge Mapping to Co-Design Nature-Based Solutions at Case Study Sites: Work Package 3 – Service Innovation: Stakeholder Participation through Living Labs, 156 pp. https://phusicos.eu/wp-content/uploads/2019/04/PHUSICOS_D3_2r_WP3_final_20190331.pdf. Accessed 4 January 2021.

Fohlmeister, S., Zingraff-Hamed, A., Lupp, G., Pauleit, S., 2018. Guiding Framework for Tailored Living Lab Establishment at Concept and Demonstrator Case Study Sites: Work Package 3 – Service Innovation: Stakeholder Participation through Living Labs. Technical University Munich, 68 pp. https://phusicos.eu/wp-content/uploads/2018/10/D3_1_GF_Final_Version_complete_201807312-Disclaimers.pdf. Accessed 7 December 2018.

Frankel, N., Gage, A., 2007. M&E Fundamentals: A Self-Guided Minicourse. USAID; MEASURE Evaluation; University of North Carolina; Carolina Population Center, Chapel Hill, 78 pp. http://www.endvawnow.org/uploads/browser/files/M_E%20Fundamentals.pdf. Accessed 4 April 2019.

Garbutt, A., 2013. Monitoring and Evaluation: A Guide for Small and Diaspora NGOs, 16 pp. https://www.intrac.org/wpcms/wp-content/uploads/2013/10/ME_A-Guide-for-Small-and-Diaspora-Organisations.pdf. Accessed 8 April 2019.

Gohl, E., 2002. prüfen und lernen: Praxisorientierte Handreichung zur Wirkungsbeobachtung und Evaluation, Bonn, 83 pp. https://venro.org/fileadmin/user_upload/Dateien/Daten/Publikationen/Handbuch/2002_Handbuch_Wirkungsbeobachtung.pdf. Accessed 10 December 2018.

Gosling, L., Edwards, M., 2003. Toolkits: A Practical Guide to assessment, monitoring, review and evaluation. 2nd Edition. Save the Children. London, UK.

Grunwald, E., Castaner, E., Germann, D.D., Safwat, A., Malak, A.A., Mikhail, H., Samra, M., Tosson, M., El Shazly, L., 2011. Monitoring and evaluation for TVET-related development interventions: A guide for practitioners. Deutsche Gesellschaft für Internationale Zusammenarbeit; FAKT Consult for Management, Training and Technologies, Cairo, Stuttgart, 74 pp. http://www.fakt-consult.de/sites/default/files/downloads/monitoring_and_evaluation_for_tvet_english_0.pdf. Accessed 7 January 2019.

GTZ, 2008. Wirkungsorientiertes Monitoring: Leitfaden für die Technische Zusammenarbeit, Eschborn. https://docplayer.org/17049717-Stabsstelle-unternehmensentwickung-wirkungsorientiertes-monitoring-leitfaden-fuer-die-technische-zusammenarbeit.html. Accessed 5 April 2019.

Gühnemann, A., 2016. Monitoring and Evaluation Manual: Assessing the impact of measures and evaluating mobility planning processes, Brussels, 51 pp.

Guijt, I., Woodhill, J., 2002. Managing for Impact in Rural Development: A Guide for Project M&E, Rome, 239 pp.

Hauck, J., Saarikoski, H., Turkelboom, F. & H. Keune, 2016. Stakeholder involvement in ecosystem service decision-making and research. OpenNESS Synthesis Paper 'Stakeholder involvement''. Online: https://repository.uantwerpen.be/ docman/irua/2fab9a/147202.pdf. Accessed 30 July, 2018.

Herweg, K., Steiner, K., Slaats, J., 1999. Sustainable Land Management. Guidelines for Impact Monitoring: Toolkit Module. A selection of practical tools and cost-effective methods. Centre for Development and Environment, Berne, 128 pp.

Hitchcock, S., 2014. Monitoring Versus Evaluation: A brief overview of these terms and their application for development actors. Fact Sheet 17. Council for International Development, 2 pp. https://www.cid.org.nz/assets/Key-issues/Good-Development-Practice/Factsheet-17-Monitoring-versus-evaluation.pdf. Accessed 15 December 2019.

Hoffmann, V., Thomas, A., Gerber, A. (Eds.), 2009. Transdisziplinäre Umweltforschung: Methodenhandbuch. oekom Gesellschaft für ökologische Kommunikation mbH, München, 267 pp.

Hüesker, F., Begg, C., Kuhlicke, C., Barquet, K., Segnetsam, L. (2018): Preparing co-creation: stakeholder analysis - Deliverable D2.1, UFZ, SEI, Leipzig (Germany), Stockholm (Sweden), 154 p.

Hughes, J., Niewenhuis, L., 2005. A Project Manager's Guide to Evaluation, Bremen, 117 pp.

IAP2, 2018. IAP2 Spectrum of Public Participation, 1 p. https://cdn.ymaws.com/www.iap2.org/resource/resmgr/pillars/Spectrum_8.5x11_Print.pdf. Accessed 2 April 2019.

IFRC, 2011. Project/programme monitoring and evaluation (M&E) guide. Planning and Evaluation Department of the International Federation of Red Cross and Red Crescent Societies, Geneva. https://www.ifrc.org/global/publications/monitoring/ifrc-me-guide-8-2011.pdf. Accessed 2 February 2019.

Innes, J.E., Booher, D.E., 1999. Consensus Building and Complex Adaptive Systems: A Framework for Evaluating Collaborative Planning. Journal of the American Planning Association 65 (4), 412–423. 10.1080/01944369908976071.

IUCN, 2019. Nature based Solutions for Societal Needs - a standardised approach for design and verification of interventions, 45 pp. https://www.iucn.org/sites/dev/files/content/documents/2019/iucn_global_nbs_standard_-_public_consultation.pdf. Accessed 14 March 2019.

Janzen, C., Fischborn, M., 2016. Lessons learned from the case studies, in: Nature-based solutions to address global societal challenges. IUCN International Union for Conservation of Nature, Gland, Switzerland, pp. 25–27.

Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., Haase, D., Knapp, S., Korn, H., Stadler, J., Zaunberger, K., Bonn, A., 2016. Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action. Ecology and Society 21 (2). 10.5751/ES-08373-210239.

Kirchner-Heßler, R., Gerber, A., Konold, W. (Eds.), 2007. Kulturlandschaft. Oekom-Verl., München.

Koppenleitner, R., Koob, E., Reàde-Soh, N., Dirinpur, J., Lang, E., Schnellbach, Klaus-Peter: Weinmann, Stefan, 2012. Wirkungsanalyse und Wirkungsmessung in Gesundheitsvorhaben der deutschen Entwicklungszusammenarbeit: Verbesserungsbedarf vor dem Hintergrund internationaler Erfahrungen und Entwicklungen, Bonn, Eschborn, 113 pp. https://www.giz.de/fachexpertise/downloads/Studie_Wirkungsanalyse_und_Wirkungsmessung_9_11_2012.pdf. Accessed 14 April 2019.

Kurz, B., Kubek, D., 2017. Kursbuch Wirkung: Das Praxishandbuch für alle, die Gutes noch besser tun wollen, 4th ed., Berlin, 141 pp.

Kusek, J.Z., Rist, R.C., 2004. Ten Steps to a Results-Based Monitoring and Evaluation System: A handbook for development practitioners. The International Bank for Reconstruction and Development / The World Bank; World Bank, Washington, DC, xiv, 248.

Ladwig, A., Auferkorte-Michaelis, N., 2012. Feedback-Methodenbar, 17 pp. https://www.uni-due.de/imperia/md/content/zfh/feedbackmethodenbar_2012.pdf. Accessed 17 April 2019.

Lahey, R., 2015. Common issues affecting monitoring and evaluation of large ILO projects: Strategies to address them. i-eval THINK Piece 9. International Labour Office, 11 pp. https://www.ilo.org/wcmsp5/groups/public/---ed_mas/---eval/documents/publication/wcms_424047.pdf. Accessed 15 March 2019.

Lamhauge, N., Lanzi, E., Agrawala, S., 2012. Monitoring and Evaluation for Adaptation: Lessons from Development Cooperation Agencies. OECD Environment Working Papers (38). 10.1787/5kg20mj6c2bw-en.

Larson, S., Williams, L., 2009. Monitoring the success of stakeholder engagement: Literature review, in: Measham, T.G., Brake, L. (Eds.), People, communities and economies of the Lake Eyre Basin, Alice Springs, pp. 251–298.

Leiner, D. J. 2019. SoSci Survey (Version 3.1.06) [Computer software]. Available at https://www.soscisurvey.de, Access: 31.3.2020

Leminen, S., 2013. Coordination and Participation in Living Lab Networks. Technology Innovation Management Review 3(11), pp. 5–14.

Lennie, J., 2011. The Most Significant Change technique: A manual for M&E staff and others at Equal Access, 47 pp. https://betterevaluation.org/sites/default/files/EA_PM&E_toolkit_MSC_manual_for_publication.pdf. Accessed 26 March 2019.

Levinson, F.J., Rogers, B.L., Hucks, K.M., Schaetzel, T., Tr(oy, L., Young, C., 1999. Monitoring and Evaluation: A Guidebook for Nutrition Project Managers in Developing Countries, 187 pp.

Luyet, V., Schlaepfer, R., Parlange, M.B., Buttler, A., 2012. A framework to implement Stakeholder participation in environmental projects. Journal of environmental management 111, 213–219. 10.1016/j.jenvman.2012.06.026.

Mackay, K., 2007. How to Build M & E Systems to Support Better Government. The World Bank, Washington, DC, 159 pp.

Malmberg, K., Vaittinen, I., Evans, P., Schuurman, D., Ståhlbröst, A., Vervoort, K., 2017. Living Lab Methodology Handbook: Handbook, 78 pp. https://u4iot.eu/pdf/U4IoT_LivingLabMethodology_Handbook.pdf. Accessed 1 December 2019.

Martin, J.; Bayer, J., Liu, W.; Scobolig, A. 2019. NBS in-depth case study analysis of the characteristics of successful governance models - Work Package 5 – Governance Innovation. https://phusicos.eu/wp-content/uploads/2019/12/D5_1_NBS-in-depth-case-study-analysis_Final-2.pdf. Accessed 6 April 2020

Marz, I., Berg, M., Andersson, A., 2018. Methodenpool: 55 Beispielmethoden mit Kurzerläuterungen für unterschiedliche Bildungs- und Erziehungsbereiche in sozialpädagogischen Einrichtungen. BBS EHS Trier, 39 pp. http://www.bbs-ehs-trier.de/schulformen/fs/fss/fss_Methodenpool_Sozialpaedagogik.pdf. Accessed 22 April 2019.

Mastelic, J., Sahakian, M., Bonazzi, R., 2015. How to keep a living lab alive? INFO 17 (4), 12–25. 10.1108/info-01-2015-0012.

McCool, S.F., Guthrie, K., 2001. Mapping the Dimensions of Successful Public Participation in Messy Natural Resources Management Situations. Society and Natural Resources 14 (4), 309–323. 10.1080/713847694.

McKinney, M., Field, P., 2008. Evaluating Community-Based Collaboration on Federal Lands and Resources. Society & Natural Resources 21 (5), 419–429. 10.1080/08941920701744215.

MDF, 2005. MDF Tool: Indicators, 10 pp. http://www.toolkitsportdevelopment.org/html/resources/40/408CC56F-509A-40D8-BE46-D7EEB4261F97/10%20Indicators.pdf. Accessed 12 March 2019.

Meo, I. de, Ferretti, F., Paletto, A., Cantiani, M.G., 2017. An approach to public involvement in forest landscape planning in Italy: a case study and its evaluation. Annals of Silvicultural Research 41 (2), 54–66. 10.12899/asr-1370.

Moote, M.A., McClaran, M.P., Chickering, D.K., 1997. Theory in Practice: Applying Participatory Democracy Theory to Public Land Planning. Environmental management 21 (6), 877–889.

Muller-Praefcke, D., Lai, K.C., Sorrenson, W., 2010. The use of monitoring and evaluation in agriculture and rural development projects: Findings from a review of implementation completion reports. Food and Agriculture Organization of the United Nations; The World Bank, http://www.fao.org/3/am292e/am292e00.pdf. http://www.fao.org/3/am292e/am292e00.pdf. Accessed 15 February 2019.

Murray-Webster, R., Simon, P. 2006. Making Sense of Stakeholder Mapping. PM World Today Tips and Techniques. Published in PM World Today - November 2006 (Vol. VIII, Issue 11) "Connecting the World of Project Management".

Nabatchi, T., 2012. A Manager's Guide to Evaluating Citizen Participation. Fostering Transparency and Democracy Series. Maxwell School of Citizenship and Public Affairs, Syracuse University, 48 pp. http://unpan1.un.org/intradoc/groups/public/documents/UN-DPADM/UNPAN048340.pdf. Accessed 25 January 2019.

Naswa, P., Traerup, S., Bouroncle, C., Medellín, C., Imbach, P., Louman, B., Spensley, J., 2015. Good practice in designing and implementing national monitoring systems for adaptation to climate change: Naturbasierte Ansätze für den Klimaschutz und Anpassung an den Klimawandel. Climate Technology Centre & Network, Copenhagen, 76 pp.

Naumann, S., Kaphengst, T., McFarland, K., Stadler, J., 2014. Herausforderung Klimawandel –die Natur als Partner, Bonn, 27 pp. https://www.bfn.de/fileadmin/BfN/biologischevielfalt/Dokumente/BfN_Naturbasierte_Loesungen_brochuere.pdf. Accessed 18 March 2019.

Nesshöver, C., Assmuth, T., Irvine, K.N., Rusch, G.M., Waylen, K.A., Delbaere, B., Haase, D., Jones-Walters, L., Keune, H., Kovacs, E., Krauze, K., Külvik, M., Rey, F., van Dijk, J., Vistad, O.I., Wilkinson, M.E., Wittmer, H., 2017. The science, policy and practice of nature-based solutions: An interdisciplinary perspective. The Science of the total environment 579, 1215–1227. 10.1016/j.scitotenv.2016.11.106.

Newig, J., 2007. Does public participation in environmental decisions lead to improved environmental quality?: towards an analytical framework. International Journal of Sustainability Communication 1 (1), 51–71.

Newig, J., Koontz, T.M., 2013. Multi-level governance, policy implementation and participation: the EU's mandated participatory planning approach to implementing environmental policy. Journal of European Public Policy 21 (2), 248–267. 10.1080/13501763.2013.834070.

Nyangaga, J.N., Grace, D., Kimani, V., Kiragu, M.W., Langat, A.K., Mbugua, G., Mitoko, G., Kang'ethe, E.K., 2012. Outcome mapping for fostering and measuring change in risk management behaviour among urban dairy farmers in Nairobi, Kenya. Tropical animal health and production 44 (1), 47-51. 10.1007/s11250-012-0206-1.

Oberndörfer, D., Hanf, T., Weiland, H. (Eds.), 2010. Verfahren der Wirkungsanalyse: Ein Handbuch für die entwicklungspolitische Praxis. Arnold Bergstraesser Institut, Freiburg i. Br., 247 pp.

PATH, 2013. Guide to Monitoring and Evaluation of Advocacy, Communication, and Social Mobilization to Support Tuberculosis Prevention and Care. USAID, 70 pp. https://path.azureedge.net/media/documents/TB_acsm_me_guide.pdf. Accessed 25 March 2019.

Paulus, I., 2008a. Leitfaden Wirkungsorientierung in den Projekten und Programmen der Welthungerhilfe: Teil II: Wirkungsorientierung Schritt für Schritt, Bonn, 27 pp.

Paulus, I., 2008b. Leitfaden Wirkungsorientierung in den Projekten und Programmen der Welthungerhilfe: Teil III: Instrumente und Methoden, Bonn, 119 pp.

Peterjohann, H., 2016. Projektmanagement: Berichte. Peterjohann Consulting, 40 pp. https://www.peterjohann-consulting.de/_pdf/peco-pm-berichte.pdf. Accessed 3 April 2019.

Posse, N., 2014. Methodenkoffer Moderation: für Schulleitungen und Beratungspersonen. IQES, 112 pp. https://www.bug-nrw.de/fileadmin/web/Dateien_Netzwerkveranstaltungen/18.03.14_Kooperatives_Lernen_in_Konferenzen_und_Sitzungen/Moderatorenkoffer_gesamt.pdf. Accessed 22 April 2019.

Rassmann, K., Smith, R., Mauremootoo, J., Wilson-Grau, R., 2013. Retrospective 'Outcome Harvesting': Generating robust insights about a global voluntary environmental network. Better Evaluation. https://pdfs.semanticscholar.org/f3fb/774713b0e28df6695c8bd205b3b7bd96f946.pdf. Accessed 26 March 2018.

Raymond, C.M., Berry, P., Breil, M., Nita, M.R., Kabisch, N., Bel, M. de, Enzi, V., Frantzeskaki, N., Geneletti, D., Cardinaletti, M., Lovingner, L., Basnou, C., Monteiro, A., Robrecht, H., Sgrigna, G., Murani, L., Calfapietra, C., 2017a. An impact evaluation framework to support planning and evaluation of nature-based solutions projects: Prepared by the EKLIPSE Expert Working Group on nature-based solutions to promote climate resilience in urban areas, Wallingford, United Kingdom, vi, 71.

Raymond, C.M., Frantzeskaki, N., Kabisch, N., Berry, P., Breil, M., Nita, M.R., Geneletti, D., Calfapietra, C., 2017b. A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. Environmental Science & Policy 77, 15–24. 10.1016/j.envsci.2017.07.008.

Reed, M.S., 2008. Stakeholder participation for environmental management: A literature review. Biological Conservation 141 (10), 2417–2431. 10.1016/j.biocon.2008.07.014.

Reed, M.S., Curzon, R. 2015. Stakeholder mapping for the governance of biosecurity: a literature review, Journal of Integrative Environmental Sciences 12(1), pp. 15-38.

Reed, M.S., Vella, S., Challies, E., Vente, J. de, Frewer, L., Hohenwallner-Ries, D., Huber, T., Neumann, R.K., Oughton, E.A., Sidoli del Ceno, J., van Delden, H., 2018. A theory of participation: what makes stakeholder and public engagement in environmental management work? Restoration Ecology 26, 7-17. 10.1111/rec.12541.

Reuber, M. and O. Haas, 2009. Evaluations at the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH. German Technical Cooperation. Eschborn. 16p.

Richards, C., Blackstock, K., Carter, C., 2007. Practical Approaches to Participation. The Macaulay Institute, Aberdeen.

Ridder, D., Mostert, E. & H.A. Wolters, 2005. Learning together to manage together. Improving participation in water management. Harmonizing Cooperation in Planning (HarmoniCop) comp., ed. and designed by the HarmonyCop Team; core ed. team: D. Ridder, E. Mostert, H.A. Wolters. University of Osnabrück, Osnabrück, 99p.

Rist, S., Chidambaranathan, M., Escobar, C., Wiesmann, U., Zimmermann, A. 2007, Moving from sustainable 689 management to sustainable governance of natural resources: the role of social learning processes in 690 rural India, Bolivia and Mali. Journal of Rural Studies 23, (1), pp. 219-237.

Rose, M., Wanner, M., Hilger, A., 2018. Das Reallabor als Forschungsprozess und -infrastruktur für nachhaltige Entwicklung: Konzepte, Herausforderungen und Empfehlungen. NaWiKo Synthese Working Paper 1, 30 pp. https://nachhaltigeswirtschaften-soef.de/sites/default/files/NaWiKo%20Synthese%20Working%20Paper%20No%201_0.pdf. Accessed 3 April 2019.

Rosener, J.B., 1981. User-Oriented Evaluation: A New Way to View Citizen Participation. The Journal of Applied Behavioral Science 17 (4), 583–596. 10.1177/002188638101700412.

Rowe, G., Frewer, L.J., 2000. Public Participation Methods: A Framework for Evaluation. Science, Technology, & Human Values 25 (1), 3–29. 10.1177/016224390002500101.

Rowe, G., Frewer, L.J., 2004. Evaluating Public-Participation Exercises: A Research Agenda. Science, Technology, & Human Values 29 (4), 512–556. 10.1177/0162243903259197.

Samaddar, S., Okada, N., Choi, J., Tatano, H., 2017. What constitutes successful participatory disaster risk management? Insights from post-earthquake reconstruction work in rural Gujarat, India. Natural Hazards 85 (1), 111–138. 10.1007/s11069-016-2564-x.

Sera, Y., Beaudry, S., 2007. Monitoring & Evaluation: Tips for Strengthening Organizational Capacity. https://www.academia.edu/31643781/Monitoring_and_Evaluation. Accessed 7 January 2019.

Sharp, D., Salter, R., 2017. Direct Impacts of an Urban Living Lab from the Participants' Perspective: Livewell Yarra. Sustainability 9 (10). 10.3390/su9101699.

Singer-Brodowski, M., Beecroft, R., Parodi, O., 2018. Learning in Real-World Laboratories: A Systematic Impulse for Discussion. GAIA - Ecological Perspectives for Science and Society 27 (1), 23–27. 10.14512/gaia.27.S1.7.

Singh, K., Chandurkar, D., Dutt, V., 2017. A practitioners' manual on monitoring and evaluation of development projects. Cambridge Scholars Publishing, Newcastle upon Tyne, 230 pp.

Smith, G., 2009. Democratic Innovations: Designing institutions for citizen participation. Cambridge University Press, Cambridge, 226 pp.

Smutylo, T., 2005. Outcome mapping: A method for tracking behavioural changes in development programs. ILAC Brief 7, 4 pp. https://cgspace.cgiar.org/bitstream/handle/10568/70174/ILAC_Brief07_mapping.pdf?sequence=1&isAllowed=y. Accessed 5 April 2019.

SOAS, 2013. Unit Ten: Monitoring and Evaluation. University of London, London, 60 pp. http://www.fao.org/3/a-au767e.pdf. Accessed 14 March 2019.

Späth, L., Scolobig, A., Patt, A., Hildebrand, J., Molinengo, V., Evensen, J., Rudberg, B., Julloer, J., Reyhanloo, T., Jullier, J., 2014. INSPIRE-Grid. Improved and enhanced stakeholder participation in reinforcement of electricity grid: Establishing the best practices and determining a toolbox. Eidgenoessische Technische Hochschule Zürich, Zürich, 73 pp.

Spreckley, F., 2006. Project Cycle Management Toolkit, 3rd ed., Herefordshire.

Steen, K., van Bueren, E., 2017. Urban Living Labs: A living lab way of working. Amsterdam Institute for Advanced Metropolitan Solutions, Amsterdam, 91 pp.

Steiner, K., Herweg, K., Dumanski, J., 2000. Practical and cost-effective indicators and procedures for monitoring the impacts of rural development projects on land quality and sustainable land management. Agriculture, Ecosystems and Environment 81 (2), 147–154. 10.1016/S0167-8809(00)00188-2.

Stem, C., Margoluis, R., Salafsky, N., Brown, M., 2003. A Review of Monitoring and Evaluation Approaches and Lessons Learned in Conservation: Summary Results from the Measuring Conservation Impact Initiative. Foundations of Success; Wildlife Conservation Society; Conservation International, Durban, 17 pp. https://pdfs.semanticscholar.org/2d4e/920481a039652338bea92590a10b90c3c501.pdf. Accessed 7 April 2019.

Stockmann, R., 2004. Was ist eine gute Evaluation: Einführung zu Funktionen und Methoden von Evaluationsverfahren. CEval-Arbeitspapiere 9. Centrum für Evaluation, Saarbrücken, 20 pp. http://new.ceval.de/modx/fileadmin/user_upload/PDFs/workpaper9.pdf. Accessed 5 February 2019.

Stringer, L.C., Dougill, A.J., Fraser, E., Hubacek, K., Prell, C., Reed, M.S., 2006. Unpacking "Participation" in the Adaptive Management of Social-ecological Systems: a Critical Review. Ecology and Society 11 (2).

Swiderska, K., King-Okumu, C., Monirul Islam, M., 2018. Ecosystem-based adaptation: a handbook for EbA in mountain, dryland and coastal ecosystems, London, 118 pp.

The World Bank, 2014. Cases in Outcome Harvesting: Ten pilot experiences identify new learning from multi-stakeholder projects to improve results, Washington, DC, 105 pp. https://www.outcomemapping.ca/download/en_Cases%20in%20Outcome%20Harvesting.pdf. Accessed 6 April 2019.

Tuckermann, B.C., 2007. Challenges and key success factors to integrating learning and change in monitoring and evaluation of development projects: Case study of an urban agriculture project in eastern Cuba. Knowledge Management for Development Journal 4 (1), 21–30.

UKaid, United States Institute for Peace. Indicator Module, n. Y. http://dmeforpeace.org/sites/default/files/3.9%20Indicators.pdf. Accessed 11 March 2019.

UNDP, 2009. Handbook on Planning, Monitoring and Evaluating for Development Results. United Nations Development Programme, New York, 220 pp. http://web.undp.org/evaluation/handbook/documents/english/pme-handbook.pdf. Accessed 19 March 2019.

UNDP, 2013. Discussion Paper: Innovations in Monitoring & Evaluating Results, 25 pp. https://www.undp.org/content/dam/undp/library/capacity-development/English/Discussion%20Paper-%20Innovations%20in%20Monitoring%20&%20Evaluating%20Results%20%20(5).pdf. Accessed 26 March 2019.

UNESCO, 2009. On Target: A Guide for Monitoring and Evaluating Community-Based Projects, Paris, 95 pp. https://unesdoc.unesco.org/ark:/48223/pf0000186231. Accessed 4 April 2019.

Vahlhaus, M., Gajo, M., Singer, C., 2011. Handreichung für die Projektfortschrittskontrolle (PFK), Eschborn, 77 pp. https://docplayer.org/14299256-Handreichung-fuer-die-projektfortschrittskontrolle-pfk.html. Accessed 3 April 2019.

Van den Brink, M., Fidder, R., Remmers, J., Schoonderbeek, J., 2018. An Urban Living Lab Approach for the Implementation of Climate Change Adaptation Measures: Opportunities for Hovinbyen, Oslo. Wagening University, Oslo, 86 pp. https://newwaterways421475860.files.wordpress.com/2018/08/act-report-final-with-appendix-2-0.pdf. Accessed 9 April 2019.

Van den Hove, S., 2000. Participatory approaches to environmental policy-making: the European Commission Climate Policy Process as a case study. Ecological Economics 33 (3), 457–472. 10.1016/S0921-8009(99)00165-2.

Van der Jagt, A.P.N., Smith, M., Ambrose-Oji, B., Konijnendijk, C.C., Giannico, V., Haase, D., Lafortezza, R., Nastran, M., Pintar, M., Železnikar, Š., Cvejić, R., 2019. Co-creating urban green infrastructure connecting people and nature: A guiding framework and approach. Journal of environmental management 233, 757–767. 10.1016/j.jenvman.2018.09.083.

Van der Jagt, A., Anton, B., Reil, A., DeBellis, Y., Fischer, L., Kowarik, I., Cvejić, R., and Mårsén, A., 2017. Cities and Researchers learning together: What does it take? Evaluating the process of iterative knowledge exchange and outcomes generated in each of the Urban Learning Labs and Learning Alliances. GREEN SURGE Deliverable 8.7. Brussels, Belgium, 63p.

Vaughn, D., 2018. Evaluating Community Engagement: An Evaluation Guide and Toolkit for Practical Use, Hartfort, CT, 9 pp. https://www.everyday-democracy.org/sites/default/files/attachments/EvDem%20Evaluation%20Guide%20and%20Toolkit_0.pdf. Accessed 13 March 2019.

Villanueva, P.S., 2010. Learning to ADAPT: monitoring and evaluation approaches in climate change adaptation and disaster risk reduction – challenges, gaps and ways forward. SCR Discussion Paper 9. Institute of Development Studies; Christian Aid; Plan International, 49 pp. https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/2509/Learning%20to%20ADAPT.pdf?sequence=1&isAllowed=y. Accessed 8 April 2019.

Vilsmaier, U., 2017. A Space for Taking a Culturally Sensitive Look at Transdisciplinarity: Report of the ITD Conference 2017. GAIA - Ecological Perspectives for Science and Society 26 (4), 352–354. 10.14512/gaia.26.4.13.

Voorberg, W.H., Bekkers, V.J.J.M. & L.G. Tummers, 2014. A Systematic Review of Co-Creation and Co-Production: Embarking on the social innovation journey, Public Management Review, DOI: 10.1080/14719037.2014.930505.

Waite, J., Bernardez, M., Calo, M., Bessouet, A., Coutin, A.-L., Deret, H., Guerrero, S., Guyot-Bender, Camille Jacob, Julien, Mattinen, H., Morel, J., Pietzsch, S., Whitney, M.S., 2011. Food Security and Livelihood Monitoring and Evaluation Guidelines: A practical guide for field workers, 222 pp. https://www.actionagainsthunger.org/sites/default/files/publications/Food_Security_and_Livelihoods_Monitoring_and_Evaluation_Guidelines_A_Practical_Guide_For_Field_Workers_10.2011.pdf. Accessed 19 March 2019.

Webler, S.T.T., 1999. Voices from the Forest: What Participants Expect of a Public Participation Process. Society & Natural Resources 12 (5), 437–453. 10.1080/089419299279524.

Webler, T., Tuler, S., Krueger, R., 2001. What is a good public participation process? Five perspectives from the public. Environmental management 27 (3), 435–450. 10.1007/s002670010160.

Wilder, L., Walpole, M., 2008. Measuring social impacts in conservation: experience of using the Most Significant Change method. Oryx 42 (4), 1–10. 10.1017/S003060530700067.

Willetts, J., Crawford, P., 2007. The most significant lessons about the Most Significant Change technique. Development in Practice 17 (3), 367–379. 10.1080/09614520701336907.

Wilson-Grau, R., 2018. Outcome Harvesting: Principles, Steps, and Evaluation Applications. Information Age Publishing Incorporated, Charlotte, NC, 1262 pp.

Wilson-Grau, R., Kosterink, P., Scheers, G., 2016. Outcome Harvesting: A Developmental Evaluation Inquiry Framework Supporting the Development of an International Social Change Network, in: Patton, M.Q., McKegg, K., Wehipeihana, N. (Eds.), Developmental Evaluation Exemplars: Principles in Practice. Guilford Publications, New York, NY.

Working Party on Aid Evaluation, 2002. Glossary of key terms in evaluation and results based management: Glossaire des principaux termes relatifs à l'évaluation et la gestion axée sur les résultats = Glosario de los principales términos sobre evaluación y gestión basada en resultados. OECD/DAC, Paris, 37 pp.

WWAP, 2003. Water for people, water for life: The United Nations World Water Development Report. UNESCO, Berghahn Books, New York, 576 pp.

Zingraff-Hamed, A., Hüesker, F., Lupp, G., Begg, C., Huang, J., Oen, A., Vojinovic, Z., Kuhlicke, C., Pauleit, S. (2020): Stakeholder Mapping to Co-Create Nature-Based Solutions: Who Is on Board? Sustainability 12, 8625. 10.3390/su12208625

H2020 Project PHUSICOS
Grant Agreement No. 776681

Appendix A

Example of a Monitoring Plan

Contents

A1 Example of a Monitoring Plan

The second row provides an example on how to fill out this table.

Table A1. Exemplary Template Monitoring Plan (based on IFRC, 2011; Paulus, 2008b)

Level of Objective	Objective	Criterion	Indicator	Data needed	Data collection methods	Data collection frequency	Responsibilities
Impact level	Living Labs help build engaged communities for replication of NBSs	Capacity building, Ownership	Number of stakeholders per case site committed to replicate/ upscale NBS*	Information on stake-holders being willing and capable of replication/ upscaling of NBS type, sector, reach, degree of commitment	Survey additionally, if resources available: Interview of key stakeholders	annual or less (e.g. midterm review, final review)	**Survey distribution, data collection and synthesis** *(= short summary of survey results, e.g. in Excel):* Local facilitator of case study site **Data analysis** WP3

*To be further defined, including target values, according to aims of a project intervention.

Appendix B

M&E Instruments and Display Options at a glance

Contents

B1 M&E Instruments and Display Options at a glance

Within this Appendix, different methods of data collection for M&E are described in more detail. Thereby, this section is divided into four clusters that arrange the individual methods in alphabetical order. Cluster 1 contains descriptions of general M&E techniques which are presented in Table 8 of Chapter 5.2, while the second cluster consists of methods, which can be used to track and display stakeholder relationships. Quick feedback methods, useful upon closure of a participatory event, are described in Cluster 3. Cluster 4 highlights different display options.

B1.1 Cluster 1: General M&E Techniques

Focus Group

Focus groups are structured group discussions which centre on a specified topic. Here, different perspectives and experiences are communicated as well as potential improvements or solutions discussed. Thereby a learning process can take place and unexpected insights can be gained (Kurz and Kubek, 2017). The recommended number of stakeholders involved in a focus group discussion varies between different authors. Charnley and Engelbert (2005) recommend six to twelve and Guijt and Woodhill (2002) four to eight participants. The groups can be either homogenous or heterogeneous, depending on the purpose. Vaughn (2018) recommends this instrument if limited resources do not allow the conduction of interviews. Kurz and Kubek (2017) point out that this tool is often supplemented by other methods.

Informal Conversation

Informal conversations can be used to validate information as well as to receive insights about unexpected outcomes of the project. Informal conservations can be conducted throughout the process and their content should be recorded as systematically as possible. One way of doing so is by using self-documentation tools such as project diaries. Few resources and skills are required to use this method. However, it is important to follow the privacy policies. Moreover, the insights cannot be generalized (Kurz and Kubek, 2017).

Interview

Interviews are helpful to consider a problem from various points of views or to gather insights about perspectives of different stakeholders, such as opinions about potential areas of improvement. Thereby, key stakeholders such as experts, participants, decision-makers and persons who are responsible for the participatory process and have a good overview about the situation are relevant to be interviewees (Kurz and Kubek, 2017). Interviews can either be structured, semi-structured (Vaughn, 2018) or open (Grunwald et al., 2011). A semi-structured or open approach allows arising questions to be asked directly (Guijt and Woodhill, 2002). This instrument has the advantage that it is inexpensive, synthesizes various opinions and can help deeping questions. However, there are also some disadvantages such as the method being time-consuming, the difficulty of analysing the results as well as finding skilled interviewers (Kurz and Kubek, 2017). The interviewing person as well as the settings can influence the answers.

As transcriptions can be time consuming (Echternacht et al., 2016), the further data use should be clearly defined to allow for efficiency.
Transferred to participatory processes, this instrument can be used in the beginning to identify needs and backgrounds of different stakeholders. A deeper understanding about their opinions and motivations can be accomplished (Echternacht et al., 2016). Moreover, the results can serve as a basis to achieve a good power balance later in the process (Meo et al., 2017). Then, this tool can be used in a more standardized version in which open questions can allow for the emergence of topics which are relevant to the participants (Dyer et al., 2014). Sharp and Salter (2017) experience this tool as useful and recommend to focus on experiences, direct impacts, challenges and ideas instead of abstract criteria.

Observation

Activities, individuals or groups can be observed to answer a specific question or to verify insights from other instruments (Kurz and Kubek, 2017). Therefore, a conceptual framework as well as guidelines are needed (Guijt and Woodhill, 2002). Observations can be performed by participating and non-participating people, e.g. taking part in a Living Lab session. Hereby, it is important to comply with privacy policies (Kurz and Kubek, 2017). As the results of this method might be biased due to the perspective of the observers or due to the observation influencing the situation, it should be supplemented by other approaches (Guijt and Woodhill, 2002).

Participatory Process Documentation / Secondary Sources Analysis:

Internal and external documents can contain important information about the project's structure, aims and results. While internal documents consist of concepts, reports and protocols, external documents include studies, statistics (Kurz and Kubek, 2017) or written statements. Additionally, secondary sources such as official statements, existing literature and newspaper articles can be evaluated if available (Hoffmann et al., 2009). Such documents can be used to verify and supplement results from surveys (Davies et al., 2015).

Self-documentation

Self-documentation of feedback, ideas and criticism is performed by stakeholders themselves and enables feedback to certain points in time or after pre-determined events. This method can take various forms, such as digital recordings, apps, blogs (Echternacht et al., 2016), diaries (Guijt and Woodhill, 2002) or a timeline of engagement starting with taking notes of the project at the beginning until its end (Dyer et al., 2014). Due to the capture of immediate and spontaneous reactions as well as the independence from potential influence by an interviewer, this method can be useful. Self-documentation should consist of three to four simple questions which are fast and easy to answer. A meeting at the start is necessary to explain the necessity of the tool as well as the duration and procedure. Motivational incentives are reasonable to keep the level of motivation high. A final meeting can provide answers to uncertainties and open questions. A drawback of this instrument is the potential delayed responsiveness to the data gathered, depending on the form and frequency of inquiry (Echternacht et al., 2016).

Survey

Surveys are commonly used as they allow the collection of data from a large number of stakeholders. They can be done online, postal or in-person and grant a certain degree of anonymity. The survey has to be constructed carefully to acquire the data needed (Vaughn, 2018) which can be a time-consuming process. Surveys can be used to gain insights about satisfaction with a participatory event as well as skills and knowledge acquired in such a session (Kurz and Kubek, 2017). The questions should assess satisfaction regarding the results, process, working atmosphere, consideration of own concerns (Kirchner-Heßler et al., 2007) and other parameters. Furthermore, this method should aim at collecting information about positive and negative experiences made as well as invite to give recommendations for improvement (Hoffmann et al., 2009). Surveys are helpful to determine to which degree certain evaluation criteria operationalized through indicators were met (Carr et al., 2012), and also to track developments over time (Hoffmann et al., 2009). However, possible drawbacks of using surveys are the restriction of answer possibilities, the lack of opportunity to ask again in case of vagueness as well as a potential low response rate (Kurz and Kubek, 2017). Surveys can be designed in various ways and employ a different number of questions. Thereby they can contain structured, semi-structured or open questions (Guijt and Woodhill, 2002).

B1.2 Cluster 2: Methods to track Changes concerning Stakeholders

Stakeholder Monitoring Graph

Van der Jagt et al. (2019) developed a Stakeholder Monitoring Graph in the framework of the GREENSURGE project, which can be used to illustrate stakeholder relationships. Moreover, it aims at evaluating “process inclusiveness and empowerment over time” (van der Jagt et al., 2019, p. 14). Here, an extended social network analysis is used to determine stakeholders and their attributes (salience, planning hierarchy). The stakeholders are arranged in a circle and while the nodes are a symbol for different stakeholders, the lines represent the connections between them. The thickness of the lines thereby portrays the strength of the relationship. Stakeholder salience is displayed by the size of the nodes while their colour coding was used to depict the hierarchical position within planning. When developing Stakeholder Monitoring Graphs at different points in time, changes can be depicted.

Venn Diagram

Venn diagrams consist of several circles each of them symbolizing a different actor or influencing factor. In an interactive approach, the circles are sized and located according to their position in the context of interest (Waite et al., 2011). Thus, this diagram can be used to illustrate the degree of interaction and the relative importance or power dynamic between different stakeholders. Moreover, different perceptions regarding the relationships are detected (Guijt and Woodhill, 2002). Generated with frequency, changes in the size and location of the circles can be analysed (Waite et al., 2011) and thus insights about changes in relationships are gained (Biancalani et al., 2004). Venn diagrams can also be used as part of a self-evaluation (Guijt and Woodhill, 2002).

B1.3 Cluster 3: Quick Feedback Methods

Flashlight

In this method, all participants voice their opinion within a defined timeframe. A question is posed to facilitate this process (Posse, 2014) such as whether the stakeholders are satisfied with the progress made in this Living Lab session. Participants' statements are not commented or judged (Ladwig and Auferkorte-Michaelis, 2012). Moreover, answers are provided voluntarily. This method does not need any preparation (Marz et al., 2018).

Dot Voting

Dot voting can be performed on a target circle divided into different elements such as personal learning, relevance of topics, atmosphere or organizational framework conditions. Each stakeholder judges each segment by drawing or sticking dots. The closer the dots are located towards the centre of the circle, the better the valuation of that very aspect. Alternatively, questions can be formulated and the dots can be pasted on scales or coordinate systems (Ladwig and Auferkorte-Michaelis, 2012). This process can take place openly or anonymously. Thus, a room for discussion is created and results can be used directly to further steer the participatory process (Kirchner-Heßler et al., 2007).

Diaries

Keeping a journal after a participatory event can contribute to self-reflection and foster learning. Such a diary can be based on impulse questions (*What did I learn? What is my conclusion after this event? What are my expectations?*) (Marz et al., 2018). Thereby, insights can be formulated on an individual basis, and e.g. personal learning goals tracked. Such diary entries might be shared with the Living Lab members or kept confidential, depending on the individual attitude and level of trust.

B1.4 Cluster 4: Display Options

Indicator Reporting/Tracking

A method commonly described in M&E guidelines is to create a sheet for each indicator which is filled out during the course of the project. It can include short information about the purpose of the indicator, its description and way of measurement. Moreover, the value at the start of the project (baseline), the dates of measuring and the target as well as "real" values should be listed (Gohl, 2002). This way, the difference between targets set and actual achievements can be determined (IFRC, 2011). A short analysis of the discrepancy and corrective measures can be added (Gohl, 2002).

Spider Web Diagram

The spider web diagram is useful to assess indicators with regard to their targets as well as to compare different case sites or projects. Moreover, change can be illustrated. Each indicator is depicted as one corner of the spider web. When valuing the indicators, it is important to agree on an equal score, for example a scale ranging from 0 to 10. A wider scale can end in complex and often unproductive discussion while a smaller scale can achieve consensus faster. However, it might only serve to show a general impression. By defining and connecting the different values for each indicator, this chart provides an overview about strengths and weaknesses of the issue assessed. Developments can be analysed by comparing diagrams developed at different points in time. This diagram is also used as a method within participatory M&E. Here, participants define the indicators considered as well as their scores. While spider web diagrams provide an overview, precise measurement details are not visible (Guijt and Woodhill, 2002).

The following spider web diagram (Fig. B.1) allows the comparison of different values of five indicators on a scale ranging from 0 to 10.

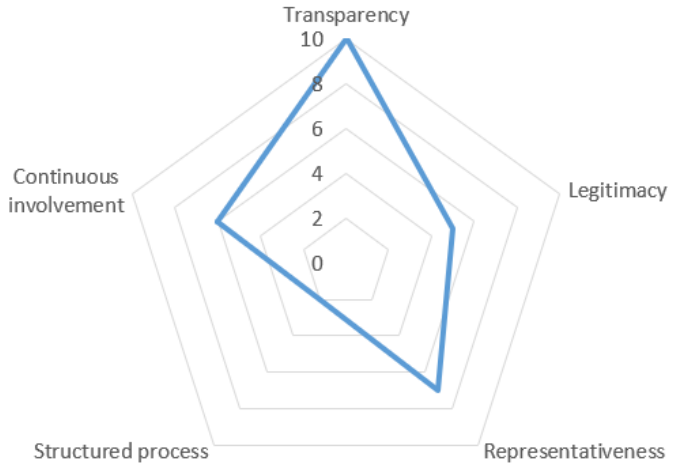

Figure B.1. Exemplary Illustration of a Spider Web Diagram visualizing Indicators and their Values (Design: M. Tiebel, 2019).

Vahlhaus et al. (2011) extended a spider web diagram by including a second set of values and thus a second line to show potential values which can be achieved within the project.

Traffic Light Method

The traffic light method can be used to rate the performance of indicators (CIToolkit, n. Y.). It provides a quick overview of their state (Peterjohann, 2016) and is usually understandable without additional information (CIToolkit, n. Y.). However, the colours have to be clearly defined to avoid wrong interpretations (Peterjohann, 2016).

Appendix C

Non-indicator based Approaches to M&E

Contents

C1 Most Significant Change (MSC) Approach

Rick Davies and Jess Dart developed the Most Significant Change (MSC) technique to monitor and evaluate a complex participatory program in rural Bangladesh in 1994[1]. Since then this approach was used by the British Department for International Development (DFID), the Swedish International Development Cooperation Agency (SIDA) and many non-governmental organizations. The MSC approach can be used for both monitoring and evaluating a project in a qualitative way (Dofel, 2010). This technique is based on collecting stories of significant change from stakeholders (Davies and Dart, 2005). People at different hierarchical levels within an organization are involved in the discussion and story selection process. Thus, a constant dialogue as well as a learning process can take place (Lennie, 2011). Moreover, the approach reveals the values that are held amongst decision-makers and enables a discussion about them. As the stories are formulated by stakeholders, unexpected and indirect results as well as a wide range of perspectives are considered. This approach is focused on outcomes and impacts of a participatory process, thus contributing to knowledge generation and to enabling improvements (Davies and Dart, 2005). Moreover, an understanding about causal links is generated (Dofel, 2010).

The MSC technique is especially suitable for projects in which unexpected change is likely and where a definition of indicators beforehand is difficult. Due to the inclusion of a wide range of stakeholders, a diverse and thorough picture of their experience is displayed (Davies and Dart, 2005). This approach has been used to detect the way people are affected by projects in general (Dart et al., 2000) as well as to measure social impact (Willetts and Crawford, 2007) or change (Wilder and Walpole, 2008) induced by a certain project. Davies and Dart (2005) do not recommend to exclusively using the MSC approach to monitor and evaluate a process, as its sampling technique is selective and a bias might occur towards successful change and popular views.

[1] Davies and Dart (2005) published a comprehensive guide to this approach which is freely available and forms the basis for the section.

C2 Outcome Mapping

Outcome mapping is an approach which can be used for project planning, monitoring and evaluation (Nyangaga et al., 2012). Outcomes are defined as changes in behaviours. More specifically, this technique monitors and evaluates changes related to stakeholders, a project's strategies and organizational practices (Earl et al., 2001). The underlying assumption is that transformation depends on the efforts of different stakeholders to achieve a common vision (Nyangaga et al., 2012). The concept enfolds in three stages: intentional design, outcome and performance monitoring, and evaluation planning. In the first stage, the desired changes and necessary measures are formulated by answering the questions why, who, what and how. The second phase defines the monitoring framework. Gradual progress markers are developed which identify change. Thereby, broad information is gathered. The last phase focuses on planning the evaluation process by pinning down priorities and resources to be used.

While Outcome Mapping provides a strategy to gather and organize data, the analysis is not part of this approach. It is a technique that can be implemented from the start of a project (Earl et al., 2001) and fosters learning (Larson and Williams, 2009). Outcome Mapping is applied by development and research organizations worldwide and can be used to determine changes of the behaviour or attitudes of stakeholders also within participatory management (Smutylo, 2005).

C3 Outcome Harvesting

Outcome Harvesting is "[a]n evaluation approach that does not measure progress towards predetermined outcomes, but rather collects evidence of what has been achieved, and works backward to determine whether and how the project or intervention contributed to the change" (UNDP, 2013, p. 5). The outcomes are identified by stakeholders using a reporting format adapted to the individual project (The World Bank, 2014). Inspired by the Outcome Mapping technique, outcomes are defined as observable behavioural change (alteration of activities, relationships, actions) of different stakeholders. Unlike other approaches to M&E, this technique focuses on these changes and works its way back to detect its causes (Rassmann et al., 2013), mainly within interventions performed in the project. In this way, the approach tries to determine the cause-effect relationship behind the developments.

Outcome Harvesting aims at providing insights to decision-makers by monitoring and evaluating changes and thus enabling a learning process. This approach is especially useful if the outcomes and causal relationships cannot be easily controlled (Wilson-Grau, 2018) or if the project takes place in "dynamic, uncertain circumstances" (Wilson-Grau et al., 2016, p. 192). Moreover, unexpected outcomes are identified (Wilson-Grau, 2018). If Outcome Mapping was used to plan the M&E, Outcome Harvesting could be used to compare the outcomes achieved against the plan (Rassmann et al., 2013). Outcome Harvesting is also suitable for managing knowledge within projects involving diverse stakeholders (The World Bank, 2014).

C4 Causal Link Monitoring

Causal Link Monitoring was developed by Britt et al. (2017)[2] and is used to combine the organization and monitoring of projects. In a first step, the intervention logic is created in which the potential relation between activities, outputs and outcomes of the intervention is depicted. The causal links are then described in more detail. Going a step ahead compared to the Result Chain approach (which develops a theory of change based on the elements input, activities, output, outcome and impact (Koppenleitner et al., 2012, see also Chap. 7.1)), contextual variables and different perspectives are also integrated into the Causal Link Monitoring model. Therefore, it considers and includes uncertainties, enabling a project team to address potential variables early on. During the performance of the project, a monitoring system can be built which assesses the causal links, activities which should lead to certain results as well as the contextual variables.

As Causal Link Monitoring tracks the processes and not only the resulting changes, information can be gathered, evaluated and integrated into decision-making ahead of time compared to other techniques. Causal Link Monitoring focuses on "the quality of implementing activities, […] contextual change, communication flows, and changes in the behaviour or capacity of partners and target groups" (Britt et al., 2017, p. 13). Thus, the approach seems to be a valuable option for the assessment of participatory processes.

[2] Britt et al. (2017) published a comprehensive guide to this approach which is freely available and forms the basis for this section.

Appendix D

The following questionnaire presents a set of questions asked to evaluate the Living Lab performance. The aim of the questions are to be understandable for different types of stakeholders with different educational backgrounds.

A basic set of questions should be asked at the end of each Living Lab session or in a follow-up close to the meeting. Depending on the selected formats and content of a session, some of the provided additional questions for certain purposes can be used to evaluate specific Living Lab content, e.g. questions related to decision-making processes. Facilitation teams are also encouraged to add site-specific questions e.g. to receive feedback together with WP3.

The following questionnaire is intended to give an overview and exemplary. To simplify data collection and handling, the use of an online survey tool is recommended. When providing the set of questions to the stakeholders as paper-based questionnaires, WP3 recommends some additional work on layout and providing enough space for comments.

Questionnaire

Evaluation of today's event from the point of view of the participants

Background

This questionnaire was developed as part of the EU Innovation and Research Program Horizon 2020, Project PHUSICOS. The project PHUSICOS (Greek for "according to nature") deals with the analysis, development and implementation of nature-based solutions to better protect mountain regions from natural hazards caused by heavy precipitation events. The project brings together 15 institutions in 5 territorial settings on the Serchio (Italy), the Pyrenees (France / Spain / Andorra), Gudbrandsdalen (Norway), Kaunertal (Austria) and the Isar (Germany). Together with different sectors comprising businesses, science, administration and civil society, good, practical and implementable solutions will be developed and implemented.

The aim of this questionnaire

The purpose of the questionnaire is to analyze your satisfaction as participants with today's event and identify your needs and wishes for improvement. This questionnaire was handed out to you by the leaders of today´s event. The information on the sheets will be confidential, anonymous and will be evaluated and assessed by employees of the Technical University of Munich. So please don´t put in names or addresses of yourself to maintain anonymity. The process of filling in should not take longer than 20 minutes. If you cannot or do not want to answer a question, feel free to skip it. You are also very welcome to comment on the questions, suggestions or other ideas. Use the back side of the sheet or directly contact the organizers of the event or us. We look forward to receiving your feedback.

Thank you for your help!

Contact information:

PHUSICOS Case Site Facilitator	**Contact information Work Package Service Innovation**
	Dr. Gerd Lupp, Dr. Aude Zingraff-Hamed Chair for Strategic Landscape Planning and Management Technical University of Munich Emil-Ramann-Str. 6 85354 Freising -GERMANY - : 08161-71-4671 E-Mail: gerd.lupp@tum.de, **aude.zingraff-hamed@tum.de**;

Part 1: To ensure that a good cross section of interested persons from all groups of society are involved, please fill in the following questions:

Q1.1 Gender

☐ Male ☐ Female ☐ Non binary
☐ Prefer not to disclose ☐ Prefer to self-describe: _____

Q1.2 Age

☐ Below 18 ☐ 18-24 ☐ 25-34 ☐ 35-44
☐ 45-54 ☐ 55-64 ☐ 65-74 ☐ Older than 75

Q1.3 Highest level of education achieved

(Need to be adapted to the context and culture of the different countries)

☐ Secondary School ☐ Grammar School ☐ Vocational Training
☐ Craftsmanship diploma ☐ University Degree ☐ None of the mentioned

Q1.4a Which type of organization do you represent in today's Living Lab session?

(Site specific tick boxes for sectors can be added if needed)

☐ Large company ☐ Small/ medium size company ☐ Self-employed
☐ Authority/Administration
☐ NGO (e.g. environmental organization)
☐ Association (e.g. land /forest owners, farmers)
☐ Interested individual person, not representing an association, NGO or company
☐ Policy
☐ Research
☐ Others, please specify: _____

Q1.4b Which sector do you represent? - several options can be ticked

(Site specific tick boxes for sectors can be added if needed)

☐ Water, Water construction ☐ Agriculture ☐ Forestry
☐ Fishing ☐ Environment/Nature protection
☐ Energy production ☐ Infrastructure
☐ Planning ☐ Education/youth work
☐ Culture ☐ Sport/Leisure
☐ Tourism ☐ Policy
☐ Engineering ☐ Research
☐ Land owner
☐ Other user group; please specify: _____
☐ Others, please specify: _____

Q1.5 On which geographical level do you work mainly for the organization you represent at the meeting?

☐ National level or federal state level
☐ Regional level
☐ County level

☐ Local at town or community level

Q1.6 How often have you participated in the meetings?

For the first Living Lab meetings

☐ Joined the meeting for the first time
☐ Attended one meeting before
☐ Attended several meetings before

Questions after 4-5 meetings

☐ Joined the meeting for the first time
☐ Attended a few meetings (< 25%)
☐ Attended regularly (half of the meetings)
☐ Attended all/most meetings (> 75%)

Q1.7 Are you willing to attend more meetings?

☐ Yes ☐ No ☐ Don´t know
Comments: _____

Q 1.8 What meeting terms would suit you best?

☐ 1 meeting per month
☐ 1 meeting every 2 months
☐ 4 meetings per year
☐ 2 meetings per year
☐ 1 meeting per year

Part 2: Satisfaction with the PROCESS QUALITY of today's meeting

Q 2.1 How was our experience with the meeting today?

Please indicate your level of satisfaction with the statement by ticking one option per line, for longer comments, feel free to make use of back site of sheet if necessary

Depending on time available time and stakeholders involved, statements and level of agreements (Lickert Scales) could be used to get more information compared of the simple approach presented here

Q2.1.1 Time of the Workshop

☐ too late ☐ too early ☐ ok

Comments:_____

Q2.1.2 Duration of the workshop

☐ too short ☐ too long ☐ ok

Comments:_____

Q2.1.3 Location of the meeting

☐ too far away ☐ should been in field ☐ ok

Comments:_____

Q2.1.4 Different participant groups and perspectives were represented at this meeting

☐ Too little ☐ Too many ☐ ok

Comments:_____

Q2.1.5 Number of participants

☐ too little ☐ too many ☐ ok

Comments:_____

Q2.1.6 Sent documents/materials to prepare for the meeting

☐ not enough ☐ too much ☐ ok

Comments:_____

Q2.1.7 Presentations/Talks

☐ too little ☐ too much ☐ ok

Comments:_____

Q2.1.8 Involvement of Participants in workshop

□ too little □ too much □ ok

Comments:_____

Q2.1.9 Level of interaction/ ability to express my opinion

□ too little □ too much □ ok

Comments:_____

Q2.1.10 Opportunity for building networks/ cooperation

□ too little □ too much □ ok

Comments:_____

Q2.1.11 Learning opportunities

□ not enough/ did know before □ felt overwhelmed □ good

Comments:_____

Q2.1.12 Facilitation of meeting today was unbiased, neutral and approachable

□ Biased □ Unbiased
□ Approachable □ Non approachable
□ Too forward □ Ok □ Not forward enough

Additional items for a good, skilled facilitation considered important can be presented as positive/negative/neutral tick boxes for this question to collect feedback for site teams

Comments:_____

Q2.2 Was there a good mix of external experts and local persons in today´s meeting?

□ Fine, well-balanced
□ Too many external experts, if yes, which ones? _____
□ Too little external experts, which ones were missing? _____

Q2.3 Were relevant local persons or groups missing?

□ No
□ Yes: Following groups were missing: Please specify which ones were missing:
_____
□ Cannot judge

Part 3: Satisfaction with the CONTENT, INVOLVEMENT & OUTCOMES of today's Living Lab Session

Basic set of questions for each Living Lab session

Please tick one option per line only

Q3.1		Strongly Disagree	Disagree	Agree	Strongly Agree	Don't know	Comments
Q3.1.1	**I had the opportunity to make my voice and opinion being heard.**						
Q3.1.2	**My voice was heard, views and important points were taken up in today's session.**						
Q3.1.3	**I learned something new and could improve some of my skills in today's session.**						
Q3.1.4	**Today´s meeting created new interesting and important insights and things**						
Q3.1.5	**Today's meeting brought forward a substantial input to further elaborate the project**						
Q3.1.6	**Today's meeting allowed me to connect and built up or strengthen networks to other interest groups.**						
Q3.1.7	**Today's Living Lab session contributed to positively influence my perception on NBS.**						
Q3.1.8	**The meeting encourages me to spread information about this project and NBS.**						

Additional Questions Q3.1a and b for specific Living Lab sessions

To keep regular evaluations for participants short, only a few from the following questions from Q3.1a and b should be selected carefully to collect additional information when needed. They should be clearly related to the specific content and purpose/targets of a Living Lab session.

Q3.1a Living Lab Process related questions

Please tick one option per line only

Q3.1a		Strongly Disagree	Disagree	Agree	Strongly Agree	Don't know	Comments
Q3.1a.1 *to be asked when scope of Living Lab is set*	**Today's Living Lab session contributed to achieve the main goals and sub-objectives, which define our Living Lab**						
Q3.1a.2 e.g. when important steps or decisions were made, e.g. NBS selection	**I knew and agreed on the objective of today´s Living Lab session**						
Q3.1a.3 When important decisions are made in a specific Living Lab session	**Participation and Decision making was communicated clearly when starting into today´s session**						
Q3.1a.4 e.g. when Living Lab session focuses on learning	**The insights and skills I gain through the Living Lab is worth the effort and time**						
Q3.1a.5 e.g. longer discussions, interaction formats or decision processes	**The atmosphere of the Living Lab session was constructive and characterized by fairness**						
Q3.1a.6 e.g. when specific tasks or decisions made in a specific Living Lab session	**The contributions of participants had an influence on relevant decisions made during the Living Lab session**						

Q3.1b Living Lab Content and Outcome

(Please tick one option per line only)

Q3.1b		Strongly Disagree	Disagree	Agree	Strongly Agree	Don't know	Comments
Q3.1b.1 e.g. when stakeholders are asked to interact with research	**I had the opportunity to influence the research agenda with my points that are important to me**						
Q3.1b.2 e.g. when having a strong focus on creating knowledge/new insights	**Participants of different backgrounds, stakeholders and viewpoints could contribute and share their knowledge. Thus, new insights were created**						
Q3.1b.3 e.g. when this was a core purpose of a session	**We co-created new knowledge between different stakeholders in today´s session**						
Q3.1b.4 e.g. when having a focus on learning	**Today´s Living Lab session strengthened my confidence to be able to contribute to the NBS co-design process**						
Q3.1b.5 e.g. when elaborating policy advice in a session	**Today´s Living Lab session will influence relevant decisions on disaster risk management**						

Q3.2 Do you recommend anything to improve for the next Living Lab session, e.g. improvements?

Thank you for your help!

Appendix E

Monitoring and Evaluation of Living Lab Processes

Self-Evaluation Sheet for Facilitators of a Living Lab Session

- Facilitator Perspective -

To be used after each Living Lab session to reflect facilitation and to identify needs and supporting activities for WP3

Goal of the Self-Evaluation Template

In order to support the local case study sites in the quality management of their Living Lab processes towards successful NBS co-design, WP3 has conceptualized this survey template as part of the M&E system to help tracking the Living Labs' advancement towards the objectives described in the DoA of PHUSICOS.

It is intended to be a monitoring and supporting tool for effectively steering the Living Lab process according to PHUSICOS standards. This questionnaire is intended to structure the reflections of the facilitator and site owners about the Living Lab sessions, success factors, development of the process, preparation of forthcoming meetings, reflection on useful formats, tools and to identify potentials of improvement or adaption of the process.

Mode of Use of the Self-Evaluation Template and further Proceedings

The best way to use this sheet is after completion of a Living Lab session to reflect on it in terms of **process quality, content** and **outcomes**. In this way, you can also identify possible potentials of improvement for the next Living Lab session. Furthermore, you may also compare your own perspective to your stakeholders' one (see respective survey sheet).

The survey should take around 20 minutes to go through. In case you are a facilitator team, feel free to use more than one sheet to document your impressions. You may also jointly discuss the impressions on your session, and/or document deviating opinions in one sheet only. We suggest that the completed survey sheets are also **forwarded to the WP3 team** to receive feedback about materials and tools. This also helps WP3 to better provide support for the case site needs.

For further questions or comments regarding the survey outline and M&E process, please contact us.

Thank you for your time and efforts!

Part 1: Today´s Living Lab Session in a Nutshell

Case Site/Measure	
Facilitator Name(s)	
Date	
Location	
Meeting time and duration	
Format	☐ Workshop ☐ Excursion/field trip ☐ Conference ☐ Exhibition ☐ Presentation ☐ Panel Discussion ☐ Other Format Please also describe briefly in own words:
Number of Participants	
All stakeholders or just a certain group (e.g. for working on a specific sub-topic)	
Goals of the meeting or session	
Were goals met today? – Please describe briefly your impressions	☐ Fully met ☐ partly met ☐ not met ☐ others
Key outcomes of the session	

Part 2: Use and suitability of tools and formats

Please briefly describe which tools, methods or formats used in today´s session (e.g. group discussions, World Café, Scenario development). How did they help to support the goals of today's event or the process as a whole? If they didn´t work the way you wanted, what might have been the reason for this?

Tools, methods and formats perceived positive

Used Tools	Rating with **++, +, 0**	Short comment, why you considered it positive, if needed, please also mention points of critique or challenges even if the tool as worked

Tools, methods and formats that were less helpful or not effective

Used Tools	Rate with **0, -, --**	Short comment, why you considered it not helpful or effective (e.g. unsuitable tool in general, did not work for this question or not feasible for stakeholder groups, other reasons)

Space for comments (e.g. if you want to address something for WP3, e.g. training needs, more similar tools, supporting activities by WP3, etc.):

Part 3: Reflection on Preparation of today´s Living Lab Session

Q 3.1 Did all the stakeholders/stakeholder groups intended to be at today´s session attend?

☐ Yes
☐ Partly ☐ No

Q3.2a The following stakeholder groups were missing or underrepresented for today´s workshop

_____

_____

Q3.2b What might have been the reason and what could be a strategy to have them better represented at a future meeting? *Examples: availability of stakeholders e.g. farmers were on harvest, topics of interests etc.:*

_____

_____

Part 4: Reflections on the participation and outcomes of the Living Lab session

Q4.1 Did all Participants bring in topics and aspects in that they were important for them?

☐ Yes, feel confident with this statement ☐ Yes, but not sure
☐ Partially ☐ No, but I am not sure
☐ No, I feel confident making this statement

If participants only partially or did not to contribute their demands or Interests? What might have been the reasons for this? (e.g. methods chosen were not suitable, a few dominant actors?)

_____

_____

What might be strategies for the next session to better integrate all stakeholders, their views and topics?

_____

_____

_____

Q4.2 Were topics, points or ideas brought in by stakeholders last time taken up?

☐ Yes
☐ Partly ☐ No

If partly or no, please explain briefly.
If yes, which topics were taken up?

_____

_____

_____

Q4.3 Were decisions or bigger steps forward taken in today´s session taken based on inputs from stakeholders?

☐ Yes
☐ Partly ☐ No

If partly or no, please explain briefly.
If yes, which topics were taken up?

_____

_____

_____

Q4.4 Could you observe from your perspective that today's event has helped participants to gain more knowledge and acceptance of NBSs?

☐ Yes ☐ No
☐ Partially ☐ Cannot judge on this from my perspective

Please briefly explain your statement

_____

_____

_____

Q4.5 Did you from your point of view as a facilitator observe today´s session has encouraged participants to engage in finding NBS solutions, that everybody can live with well?

☐ Yes ☐ No
☐ Partially ☐ Cannot judge on this from my perspective

Please briefly explain your statement

_____

_____

_____

Q4.6 Did you from your point of view as a facilitator observe that participants and stakeholders after today´s session feel more committed to NBSs? This means, that they will communicate positive about NBS, disseminate and spread NBS solutions to replicate and upscale NBSs.

☐ Yes ☐ No
☐ Partially ☐ Cannot judge on this from my perspective

Please briefly explain your statement

_____

_____

_____

Q4.7 What would be your conclusions and lessons learned from today´s Living Lab session?

Q4.8 What will be your suggestions for preparing the next Living Lab session?

Q4.9 What will be your conclusions from today´s session for preparing and considering key aspects of Living Lab processes for the next meeting?

	Fully disagree	Disagree	No need to change	Agree	Fully agree	Cannot reply/not applicable	Comments
For the next meeting, more time will be needed to prepare (e.g. refection on used tools, materials for participants)							
For the next meeting, Invitations need to be sent/communicated earlier so more participants will be able to attend							
For the next meeting, more/ additional material needs to be provided for the stakeholders so they can better prepare							
For the next meeting, participants need more time and opportunities for learning something new							
For the next meeting, participants will need more time and opportunities for exchange and forming networks with other participants and groups							
Other considerations?							

Q4.10 Comments, Remarks, Suggestions and ideas for PHUSICOS and WP3?

Thank you very much for your Participation!

Appendix F

Template for Description of a Living Lab Work Plan and Roadmap

Local facilitator teams define the intended focus and scope of co-design, approaches, how to identify and document the Living Labs. This appendix intents to support the development of a strategy paper by site owners and facilitators for this purpose. Making use of the appendix F template section F1, sites describe their intended Living Lab actions for the project lifetime and key goals of a Living Lab processes to be achieved and targets met.

For complex processes or to better track processes and steps to be achieved, the overall strategy description for the different demonstrator and concept cases can be cut down into annual roadmaps (Appendix F, section F2) with more specific goals, strategies, detailed work plans and actions as well as sub-goals for a more foreseeable annual timeframe.

F1 Template for Description of Living Lab Strategy – Development of a Work Plan and Roadmap

Work Package 3 – Service Innovation – Living Lab processes at case sites

Key Information on local Living Lab Strategy – to be elaborated at the beginning of a Living Lab Process

Name of Case Site:
Type of Case Site: Demonstrator Case / Concept Case
LL strategy elaborated by: Name of author(s)
LL strategy elaborated on: DD.MM.YYYY

Key Information Cluster 1: Direction and Scope of Work

1.1 Key goal of Living Lab process

Please describe here in detail the key goal of the Living Lab process at your case site. You may think of the NBS stages (exploration of the problem; NBS selection; NBS co-design; NBS assessment), and relate the goal as precisely as possible to your individual context (e.g. NBS measure description with information on intended location and function of NBS measure, and exact description on the function which the Living Lab should fulfil in here).

Write here…

1.2 Sub-objectives of Living Lab process

Please describe here in detail the sub-objectives of the key goal you described above of the Living Lab process at your case site.

Write here…

1.3 Identified key topics and priority demands to work on with the Living Lab

Please describe here which key topics have been identified for the work in your Living Lab process. In this description, please also outline how these key topics evolved (e.g. within Kick-off event), i.e. whether they were defined by the Living Lab participants themselves, or by other agents.
Please also state here whether and how you have assessed the priority demands of your Living Lab stakeholders already. If so, please list the demands here; if not: when do you intend to assess them?

Write here…

1.4 Intended outcomes to be achieved by the end of the Living Lab process

Please describe here in detail which outcomes (results) shall be achieved by the end of your Living Lab process at your case site. Please outline them as detailed as possible, e.g. whether you intend to elaborate a spatial model; detailed plans for the NBS type and location(s), a vision development, a consensus contract, an upscaling strategy, the selection of NBS for other projects, product development, or any other results.

Write here…

1.5 Scope and content of Co-Design

The co-design element is decisive in a Living Lab process. Please describe here the scope and content of co-design at your case site. What shall be co-designed/co-produced more precisely by the Living Lab participants related to your case site's intended NBS process?

Write here…

Key Information Cluster 2: Participant circle, facilitators and operational background

2.1 Names of all persons / stakeholders being designated as stable group/ core circle/ continued members of the Living Lab

Please state here a list of names and affiliations of all persons/stakeholders who are designated as stable/core circle/continued members of your Living Lab, committed to work on the identified goals, outcomes and key topics throughout the lifetime of PHUSICOS

Write here…

2.2 Form of institutionalization of the Living Lab process

Please describe here how you intend to formalize your Living Lab process. E.g. do you intend to have a Memorandum of Understanding (MoU), Terms of Reference, or any other form to institutionalize your Living Lab process?

Write here…

2.3 Institutional background / frame for the Living Lab process

Please describe here the institutional background / framework, on which the Living Lab will operate. How is the Living Lab e.g. connected to any other initiatives being of relevance to the NBS process at your case site?

Write here…

2.4 Name(s) and affiliation(s) of the designated facilitator(s) to steer the Living Lab process

Please state here the name(s) and affiliation(s) of the facilitator / or facilitator team who will steer the Living Lab process which you are describing. If other than hitherto designated persons, please also add details on the professional background of the intended facilitator(s).

Write here…

2.5 Incentives / Funding on which the Living Lab operates

Please describe here the incentivation scheme/funding on which your Living Lab process operates. E.g. is there any budget in place/foreseen as a stimulus to Living Lab participants to continuously work on the identified key topics? Any other incentives you may describe?

Write here…

Key Information Cluster 3: Operationalization of the Living Lab Work Plan and Strategy for the full project lifetime

3.1 Location of Living Lab meetings

Please describe here the location(s), where your Living Lab meetings will regularly take place.

Write here…

3.2 Work plan of the Living Lab, including meeting turn; work format; work plan and meeting schedule

Please outline here your intended work plan of your Living Lab, including details on:

- Meeting turn and frequency per quarter/half-year/year;
- Work format (e.g. working group; workshop series; online platforms; retreat meetings; combination of several formats)
- Work plan
- Meeting schedule

Write here…

3.3 Planned Living Lab activities

Please describe here any important activities you foresee to undertake with your Living Lab participants, e.g. outreach, capacity-building, webinars, look and learn-visits, others.
If appropriate/already known please also add time-frames, or other details on these activities etc.

Write here…

3.4 Intended Tool application

Please describe here your intended tool application (e.g. from PHUSICOS Toolbox) which shall support your Living Lab process at your case site. Please also inform who is deemed to apply the tools, when and for which purposes more precisely.

Write here…

Additional information: Further remarks related to the Living Lab process

Add-on: Further information / remarks

Describe here any further information or remarks you'd like to add to the description of your Living Lab strategy.

Write here…

F2 Template for an Annual Living Lab Work Plan/ Roadmap at PHUSICOS Demonstrator and Concept Case Sites

Annual Roadmap for mid-20XX-mid-20XX (to be filled in annually)

Name of Case Site:

LL roadmap elaborated by: Name of author(s)
LL roadmap elaborated on: DD.MM.YYYY

Overall key goals, topics and intended outcomes for the coming year

Key goals to be achieved with the Living Lab work in the coming year
Please briefly describe your key goals of the Living Lab process you want to achieve in the coming year at your case site? Which stages do you intend to work on and how could this been seen in the context of your strategy? *Please try to relate those goals also to the set of indicators given in table 15 of the deliverable report D3.4*
Write here…

Key topics to be dealt with in the coming year
Please briefly describe the key topics that you intend to work on? Why where they were chosen to be worked on?
Write here…

Intended outcomes with the Living Lab process in the coming year
Please briefly describe what your intended outcomes?
Write here…

Involvement, interplay and engagement with different WPs

Intended/Planned involvement, interactions and interplay of other WPs
Please briefly describe what your use or ideas for involving other WPs in your Living Lab activities
Write here…

Living Lab activities in more detail in this year to reach overall key goals

Intended Living Lab Meetings, Stakeholders Involved and Activities
Please describe your rough schedule for your Living Lab meetings (remember, that 2 meetings per year are foreseen as a minimum). Try to reflect on topics for the meetings, activities, formats and application of tools, please briefly describe your intentions here. If you prefer, you could also use or develop a table such as provided example below …
Write here…

Example for description in table format

Foreseen Time of Meeting	**Topic**	**Meeting Type Format**	**Participant group**	**Activities**	**Intended use of tools** (taken from D3.2r or own experiences and expertise)	**Intended outcomes** *Relation to indicators given in table 15*	**Contribution to main goals of LL strategy**
e.g.:meeting envisaged for Oct./Nov. 2019…		e.g.: workshop, field visit, map exercise…	e.g.: Public hearing, Small core group for brainstorm, meeting of sub-working group interested in biodiversity …	e.g.: collect different perceptions of a flooding problem, brainstorming on NBS solutions, pre-selection of NBS ….	e.g.: scenario technique, Q-sort to select a set of preferred NBS solutions…	e.g.: pre-selection of three preferred NBSs to be assessed using WP4 framework…, *achieve stakeholder learning and rising awareness for NBS (Indicators I.11; awareness, I.14, innovation capacities…)*	e.g. step towards finding a measure for implementation …

Further remarks

Further information / remarks
Describe here any further information or remarks you'd like to add to the description of your Living Lab roadmap.
Write here…

Appendix G

Interview Sheets

Stakeholder Views on Nature-Based Solutions – Baseline Assessment

Qualitative Approach – repeated in-depth interviews with selected interviewees

G1 Interview Round 1

G2 Interview Round 2

G3 Interview Round 3

Quantitative Approach – Standardized Tickbox Surveys

G4 Interview Sheet

Appendix G1

Questionnaire for qualitative in-depth Stakeholder interviews Round 1

List for Questions for the WP3 Baseline Assessment

Protocol interviews with selected stakeholders

Q.0 Introductory questions:

Q 0.1 Please briefly introduce yourself, your background and your function in the organization

Q.1 Meeting the Concept of Nature Based Solutions:

Q.1.1a How have you been involved in measures or solutions to reduce hydro-meteorological risks?

Q1.1b How would you describe these solutions? Were they traditional grey engineering solutions or were ecosystem Based solutions/green engineering/Nature Based Solutions among them?

Q1.1c Have you heard about Nature Based Solutions?

Q.1.2 Which sources of inspiration or information do you use to inform, design or decide about the design and implementation of measures to reduce hydrometeorological risks?

Please reflect on potential inspirations from science and education or professional training, media (other than related to professional training or education) and role of your professional contacts but also your private surrounding

Q.1.3 PHUSICOS is a European funded research and innovation project focusing on Nature Based Solutions to reduce hydro-meteorological risks. What has been the role of PHUSICOS in getting inspirations so far and how could PHUSICOS contribute to provide inspiration for you for the design and implementation of alternative solutions to reduce hydrometeorological risks?

Q.2 Benefits of, concerns/preoccupations about and barriers for implementing Nature Based solutions

Q.2.1 What do you think are the main benefits of implementing alternatives to grey solutions?

Q.2.2 What would be your concerns about implementing alternatives to grey solutions?

Q2.3 What might be the main barriers to implementing alternatives to grey solutions?

Please reflect on technical aspects, human and societal aspects or governance aspects (regulative framework and administrative settings) that might lead to opt for a traditional grey solution or not taking action at all.

Q.3 Living Labs

In PHUSICOS, an important activity is the active involvement of participants and Stakeholders beyond a “business as usual” approach. This activity is referred to as Living Labs.

Q3.1 How can the PHUSICOS Living Labs generate new knowledge and truly develop, co-design and implement together with different stakeholders new forms of non-grey solutions to address hydrometeorological risks?

Q3.1a What might be benefits of such an approach?

Q3.1b What might be concerns of such an approach?

Q3.1c What might be barriers for such approaches?

Do these barriers exist in general or are they only related to new forms of non-traditional solutions?

Q3.2 What contents or topics would you, from your perspective, like to discuss and elaborate in the Living Labs?

Q3.3 What would you like to see as outcomes of the PHUSICOS Living Labs?

Q.3.4 Is there anything else you would like to share with us or is there something important for you that we have not asked about?

Q.3.5 Would you be willing to participate again in an interview to reflect again on these points and share your views on the experiences made with PHUSICOS?

Thank you very much for taking your time! They provide very valuable and very relevant inputs to stimulate and improve Living Lab processes.

Appendix G2

Questionnaire for qualitative in-depth Stakeholder interviews Round 2 (Repeated in-depth interviews)

List for Questions for the WP3 Baseline Assessment

Protocol interviews with selected stakeholders

Q.1 Meeting the Concept of Nature Based Solutions:

Q.1.1 Since the last interview, do you consider that you learned more about NBS?

What has been the role of PHUSICOS in this learning process?

Q.2 Benefits of, concerns/preoccupations about and barriers for implementing Nature Based Solutions

Q.2.1 Being engaged in PHUSICOS, what do you think are the main benefits of implementing Nature Based Solutions? What were the most important new insights for you until now?

Q.2.2 Since the last interview, which concerns do you have about Nature Based Solutions after your engagement in PHUSICOS?

Are they general ones related to the nature of NBS or to other factors? Did PHUSICOS help addressing these concerns? If not, what could the project do?

Q2.3 Have you experienced barriers when trying to work, plan or implement Nature Based Solutions when working in PHUSICOS?

Were they evident already before the project started and couldn´t be solved so far? Did they appear while working in PHUSICOS? In your opinion: Can they be solved during the project lifetime or can they only be solved at a later stage and/or after the project end?

Q.3 Living Labs

Q3.1a How was the experience and your satisfaction with the Living Labs so far?

Please reflect on the following points:

- Did the Living Labs develop new knowledge?
- What was the experience with co-designing so far?
- Were things and ideas from the Living Labs already put into action?
- What were the most interesting outcomes of the LLs until now?

Q3.1b What were, so far, the benefits of using Living Labs? What was the best experience or achievement so far?

Q3.1c What did not work so well so far in the Living Labs? How could this be addressed timely to improve the Living Labs in the remaining time?

Q3.1d Did you observe barriers in the Living Labs? Which ones? Are they more general ones or can they be removed timely?

Consider e.g. points such as what might slows down the ongoing processes and how this could be addressed.

Q3.2 What contents or topics would you like to discuss, elaborate or focus on in the remaining time in the Living Labs? What was not addressed so far and would be of interest for you?

Q3.3 What would you like to see as outcomes of the PHUSICOS Living Labs?

Q.3.4 Is there anything else you would like to share with us or is there something important for you that we have not asked about?

Thank you very much for taking your time! They provide very valuable and very relevant inputs to stimulate and improve Living Lab processes.

Appendix G3

Questionnaire for qualitative in-depth stakeholder interviews – Round 3

List for Questions for the WP3 Baseline Assessment

Protocol interviews with selected stakeholders

Q.1 Meeting the Concept of Nature Based Solutions

(No questions related to this section in Round 3)

Q.2 Benefits of, concerns/preoccupations about and barriers for implementing Nature Based solutions

Q.2.1 Looking back, for you, did PHUSICOS demonstrate that Nature Based Solutions are an option to address natural hazards? In what way?

Q2.2 Which were the most important benefits for your region? What interesting, surprising or new interesting outcomes for the region?

Q.2.3 Looking back, what are remaining concerns about Nature Based Solutions? How can future work in your region or in future research and development projects address them?

Q2.4 Looking back, what were the main barriers to implement Nature Based Solutions? Did PHUSICOS with the Living Labs and support from the research partners help to address or overcome them in some ways or at least contributed to describe them?

Q.3 Living Labs

Q3.1a Looking back, how was the experience and your satisfaction with the Living Labs?

Please also reflect on the following points:

- Did the Living Labs develop new knowledge?
- What was the experience with co-designing?
- Were things and ideas from the Living Labs put into action or will they be followed up after the project end?
- What were the most interesting outcomes of the Living Labs?

Q3.1b What were, in your eyes, the benefits of using such a Living Lab approach? What would be lessons learned?

Q3.1c At the beginning, you might have expressed concerns about the Living Labs. Were these concerns confirmed? If so, how?

Q3.1d Which barriers did you observe in the Living Lab processes? What slowed down or congested the processes and how could they be addressed? How were these challenges addressed (or not) solved?

Q3.2 What were the most important outcomes of the Living Labs in your eyes?

Q3.3 Can you give feedback on the used formats and events? What were the most interesting formats or events for you? Which formats were not so well and how could they be improved in the future?

Q3.4 Is there any advice on Living Labs that you would like to share with others interested applying such an approach?

Q.4 Beyond PHUSICOS

In these questions, we will look ahead and beyond PHUSICOS.

Q.4.1 Looking back, how has PHUSICOS contributed and provided inspiration for you to consider, work, design and implement Nature Based Solutions to reduce hydrometeorological risks?

Q4.2 From your perspective, did PHUSICOS encourage fellow participants and actors to continue working on NBS projects beyond the project lifetime, e.g., by spreading the word about NBS and sharing the concept with others to inspire, pick up or replicate such solutions? Can you give examples?

Q4.3 What topics should/will be followed up together with other stakeholders after PHUSICOS?

Do you think that PHUSICOS and the Living Labs generated dynamics that stakeholders will follow up on their own or will additional help or support be needed (e.g. follow up project with facilitation of the processes)?

Q.4.4 What will be the legacy of PHUSICOS for you after the project end?

(For example, continuous engagement, work on new projects, follow up ideas created in Living Labs etc.)

Q.4.5 Is there anything else you would like to share with us or is there something important for you that we have not asked about?

Thank you very much for taking your time! You have provided very valuable and relevant inputs.

Appendix G4

Interview Sheet

Stakeholder Views on Nature-Based Solutions –
Baseline Assessment, quantitative approach

Project Description

This survey is distributed in the context of the PHUSICOS project. The EU-project PHUSICOS (2018-2022) aims at fostering proof of the effectiveness of Nature-Based Solutions (NBS) as an approach to reduce the risk of extreme weather events in rural European mountain areas. The name PHUSICOS originates from the Greek term φυσικός and can be translated with "according to nature". The Innovation Action project is funded by the European Union's Horizon 2020 research and innovation program.

Mode of Use of the Assessment Template

Please fill out this anonymous survey to help us better understand the awareness and perception of nature-based solutions at your location as well as your experiences made with the Living Lab processes so far. It should take about 30 minutes. If you are not comfortable answering a question, please just skip it and move on to the next.

We are very grateful for your participation as it contributes to increase the quality of implementing NBS, the PHUSICOS project in general as well as future projects. Thank You!

If you have any questions regarding this survey or the PHUSICOS project please contact your local facilitator or Gerd Lupp, Technical University of Munich (gerd.lupp@tum.de).

Part 1: To ensure that a good cross section of interested persons from all groups of society are involved in the project, please fill in the following questions

Q.1.1 Gender

☐ Male ☐ Female ☐ Non binary
☐ Prefer not to disclose ☐ Prefer to self-describe: _____

Q1.2 Age

☐ Below 18 ☐ 18-24 ☐ 25-34 ☐ 35-44
☐ 45-54 ☐ 55-64 ☐ 65-74 ☐ Older than 75

Q1.3a Which type of organization do you represent in the process? (Please tick only one which represents you the most)

☐ employed in large company
☐ employed in Small/ medium size company
☐ Self-employed
☐ Authority/Administration
☐ NGO
☐ Association (e.g. land /forest owners, farmers)
☐ Interested individual person, not representing an association, NGO or company
☐ Politician (e.g. mayor, councilor, Member of Parliament)
☐ Research
☐ Others, please specify: _____

Q1.3b Which sector do you represent?

☐ Water/River management ☐ Agriculture
☐ Forestry ☐ Policy
☐ Aquaculture, professional fishing ☐ Environment/Nature conservation
☐ Energy production ☐ Infrastructure building
☐ Planning ☐ Education/youth work
☐ Culture ☐ Sport/Leisure (e.g. hobby fishing)
☐ Tourism and Gastronomy ☐ Research
☐ Civil Society
☐ Other user group; please specify: _____
☐ Others, please specify: _____

Q1.4 On which geographical level do you work mainly for the organization you represent at the meeting?

☐ National level or federal state level
☐ Regional/County level
☐ Local at town or community level

Part 2: Questions related to the Concept of Nature Based Solutions (NBS)

Q2.1 Which sources did you use to inform yourself and specifically to learn about nature-based solutions?

PHUSICOS Project

- ☐ Project information
- ☐ Handout material previous to a meeting
- ☐ Information during PHUSICOS meetings, workshops, Living Lab sessions

Media

- ☐ Internet
- ☐ Social Media
- ☐ TV
- ☐ Newspapers
- ☐ Other media sources

Personal Contacts

- ☐ Institutions, Authorities
- ☐ Environmental Organizations
- ☐ Research
- ☐ Colleagues
- ☐ Friends/Family
- ☐

Professional Background

- ☐ During vocational training, study
- ☐ Training course for professional development
- ☐ Talk, Presentation, e.g. at a Conference

- ☐ Others, please specify: _____

- ☐ None of them

Q2.2 Do you feel that you have a good understanding of the Nature Based solutions concept or do you still need more information to get more familiar with the concept? (Please tick only one)

- ☐ I feel that I am very familiar concept.
- ☐ I feel that I understood the concept, but still have some uncertainties and questions.
- ☐ I barely understand the concept
- ☐ I have not really an idea what Nature Based Solutions are.

Q2.3 Please judge on the following statements on nature-based solutions:

Nature-Based Solutions and risk reduction - Please tick only one option per line

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
Nature Based solutions reduce the risks of extreme weather events						
Nature Based solutions provide good adaptation to climate change						

Nature Based Solutions and Technical Aspects - Please tick only one option per line

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
Nature Based solutions have a good cost-benefit ratio						
Nature Based solutions are easy to implement						
Nature Based solutions are very robust						

Social and Economic Aspects of Nature Based Solutions - Please tick only one option per line

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
Nature Based solutions create jobs						
Nature Based solutions create business opportunities and local value chains						
Nature Based solutions increase the quality of life						
Nature Based solutions provide possibilities for recreational activities						
Nature Based solutions create identity for a place						
Nature Based solutions make areas attractive						
Nature Based solutions increase property values						

Nature-Based Solutions and Ecology Please tick only one option per line

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
Nature-based solutions contribute to cleaner water and better air quality						
Nature-based solutions increase diversity in flora and fauna						
Nature-based solutions allow better discovering and understanding nature						

Q2.4 What is your opinion about the following statements related to concerns on Nature Based solutions Please tick only one option per line

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
Nature Based solutions are not as effective as technical solutions						
Nature Based solutions are less reliable than technical solutions						
Nature Based solutions need too much time until they work						
Nature Based Solutions increase health problems (allergies, etc.)						
Nature Based Solutions lead to an increase of insects and other unwanted animals or plant						
Nature Based Solutions are expensive and/or have a negative cost-benefit ratio						
Nature Based Solutions will not be properly maintained over time						
Nature Based Solutions reduce usability and access of an area						
Nature Based Solutions will increase risk of accidents and injuries to humans						

Q2.4 What might be the main barriers to apply Nature-based solutions according to your opinion? Please tick only one option per line

	Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Don't know
Lack of (technical) knowledge						
Lack of good examples for Nature Based solutions						
Uncertainties about potential effects and impacts						
Lack of financial resources						
Lack of available land						
Lack of political will						
Lack of supporting legal framework						
Lack of technical standards for Nature Based Solutions						
Lack of empathy for nature						
Missing of intersectoral collaboration						
Nature-based solutions are not seen as a priority						
Proposed nature-based solutions do not fit or suit for the local conditions						
Lack of long-term maintenance and related funding						

☐ Others, please specify: _____

Part 3: Questions related to further interest in Nature-based Solutions (NBS)

Q3.1 If a nature-based solution was to be implemented, would you like to do any of the following?

☐ Participate in planning and decision-making
☐ Volunteer with advice or expertise
☐ Volunteer with work
☐ Share information or promote the project
☐ No, I would or could not do anything

Q3.2 Do you consider spreading and talking to your contacts about the experiences made with nature-based solutions and the concept of Nature Bases solutions?

☐ Yes
☐ No, I would or could not do anything
☐ No, I think they would not be interested in this topic

Comments: _____

Q3.3 Do you have questions about nature-based solutions that should be addressed in PHUSICOS, in the Living Lab sessions or an upcoming meeting?

☐ Yes: _____
☐ No

Q3.4 Is there anything else you would let us like to know?

_____

Thank you for your help!

Appendix H

Stakeholder Mapping Table (following RECONECT Methodology)

Stakeholder analysis – Also first step to identify interview partners for systematic sampling

1	2	3								4						5						6	7	8
Stakeholder is from…		Role of Stakeholders								Important for Living Lab stage						For the following statements, please rate if stakeholders are least (1), moderate (2), most (3) affected, affecting or interested. Please put ?, if you don´t know, n.a. if the statement is not applicable						Attitude towards NBS Please rate with + (positive) 0 (neutral) - (negative) Please put ?, if you don´t know, n.a. if not applicable		Comments
	Please fill in the respective stakeholders (add lines if necessary)	Decision-makers	Implementers	Coordinators	Providers of expert knowledge	Funders/Sponsors	Lobbyists	Mediators	User of found solution (NBS, hybrid or grey)	Assessment and planning	NBS Selection process	Design	Implementation	Monitoring	Evaluation	Affected by natural hazards	Affecting natural hazards	Affected by potential NBS/hybrid or grey solution	Interest in NBS	Affecting decisions on NBS	Affecting implementation on NBS	Attitude towards NBS	Sufficient English skills for answering survey questions	
SG1 Authorities																								
SG2 Political Representatives																								
SG3 Civil Society, NGO, Land Owners																								

SG4a Commercial Sector, large companies																								
SG4b Commercial Sector, SME																								
SG5 Academia / Research																								
SG6 Media (if they are relevant for your site)																								
SHG7 International and transnational organizations (if relevant for your site)																								