Methodological framework for case studies

ROBUST Deliverable 3.1

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Abstract

D3.1 sets out the methodological framework for the case studies, building on the general framework provided in the conceptual framework (Task 1.3). The guidelines provide a flexible resource that is structured but not prescriptive, providing partners with a range of options to reflect their circumstances and preferences. The guidelines should be used by research teams as part of a cyclical, iterative, participatory process. They are structured as follows. They start by introducing key concepts that inform WP3's approach to knowledge creation (epistemology), especially 'Living Labs' and 'Communities of Practice'. A methodological framework to implement Living Labs and Communities of Practice in ROBUST is then outlined, including monitoring and evaluation of learning processes. Templates for the Living Lab and Communities of Practice research and innovation plans and for reporting (for the place-based and thematic case studies) are then presented to guide the research project and write up of results. A case study toolbox of different methods that can be used to foster joint learning between researchers and practitioners is presented at the end of the document and forms a key component of the guidelines (as a resource for co-learning and co-innovation).

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Work-package title: In-depth case studies

Aim and Objectives

Aim: to explore and analyse rural-urban relations and synergies in five thematic fields, across 11 case study areas.

Objectives:

- To improve our understanding of both place-specific and thematic functional rural-urban linkages and their dynamics and determinants.
- To identify and assess the potentials and bottlenecks for enhancing mutually beneficial relations between rural, peri-urban and urban areas in 11 diverse territorial settings.
- To learn from sharing and comparing experiences from diverse rural-urban settings.
- To reflect on the multi-method and multi-actor joint learning process of ROBUST.

Work-package 3 tasks to be undertaken by the partners involved

The work for this work-package is divided into five main tasks, which includes place-based analysis (living lab level) and thematic analysis (communities of practice).

Task 3.1: *Design and refinement of an overarching case-study methodology*
(M15-18; Task-leader: UoG; Contributions: WU, WP4 & 5 Coordinators (UVEG, LUKE))

Task 3.2: *Place-based case studies (Living Labs [LL])*
(M18-44; Task-leader: UoG; Input: all research-practice partner teams)

The research-practice partner teams in each Living Lab will develop and implement their own **research and innovation agenda**, focusing on their three chosen priority themes. This agenda is primarily led by the questions and needs of the practice partners.

Task 3.3: *Thematic case studies (Communities of Practice [CoP])*
(M18-44; Task leaders: Community-coordinators (PRAC, BABF, OIKOS, BSC, IST); Input: all research-practice partner teams)

The research-practice partner teams participating in a specific thematic **community of practice** will define the goals, data to be collected and the shared activities to be undertaken.

Task 3.4: *Monitoring and evaluation of joint learning process.*
(M18-44; Task-leader: UoG; Contributions: research-practice partner teams and thematic field coordinators (PRAC, BABF, OIKOS, BSC, IST))

This task will elaborate a **monitoring and evaluation framework** (including identifying success criteria), encompassing the categories of process, context and outcomes, as well as setting out a range of methods that will allow for their assessment in a participatory manner.

Task 3.5: *Final WP report*

(M40-44; Task-leader: UoG; Contributions: research-practice partner teams and thematic field coordinators (PRAC, BABF, OIKOS, BSC, IST)).

This task will provide a synthesis of place-based and thematic findings re. rural-urban synergies, innovative governance arrangements and learning processes.

WP3 Deliverables

Table 1 - WP3 Deliverables

Deliverable	Comment
D3.1. Methodological framework for case studies (M18)	The framework will be flexible in the sense that it can accommodate the cyclical, iterative and participatory process of the case study work.
D3.2. Five summary reports of functional relations (M40)	A summary report for each community of practice will be prepared by the theme leaders (community of practice facilitator); each report will follow common reporting guidelines.
D3.3. Synthesis Report (M44)	The final report will synthesize the results of the place-based as well as the thematic case studies, it will also reflect on the iterative and participatory joint-learning processes that have been followed within each of the case studies.

Timetable

Table 2- Timetable for WP3

Task	Timing	Comment
Task 3.1: Case-study methodology **(D3.1)**	Draft guidelines end of Oct 2018. Revise guidelines end of Nov 2018 (D3.1). Final guidelines end of Jan 2019 (M20).	Guidelines from UoG. Input from WP4 (synergies) and WP5 (governance) leaders. PRAC provide a simplified method for analysis of socio-economic development.
Task 3.2: Place-based case studies	Draft Living Lab Research and Innovation Agenda by mid-Dec 2018 (M19). Living Lab agendas finalised by the first week of Feb 2019 (M21).	All partners. UoG, WU, WP1, WP4 and WP5 leads feedback on LL agendas by mid-Jan 2019.
	Research-practice partners implement LL research plan: Feb 2019 (M21) to Sept 2020 (M40).	All partners. Work through LL phases (envisioning, experimenting, experiencing, evaluating and monitoring)
	Draft living lab report June 2020 (M37); internal review of LL reports. LL reports finalised: Sept 2020 (M40).	Partners draft LL report by M37 for internal review/quality checking, plus feedback from LL participants.
Task 3.3: Thematic case studies	CoP leaders draft CoP Research Plan mid-Feb 2019. CoP leaders finalise CoP plan by end of Feb (M21).	CoP leaders to liaise with CoP members to agree/finalise plan; use common template for CoP plan. WP4 and WP5 leads to review / feedback on CoP plans.
	Implement agreed CoP plan: March 2019 (M22) to Sept 2020 (M40); exchanges at thematic workshops, plus additional meetings/exchanges (as appropriate).	CoPs meet three times at thematic workshops (linked to D4.2, D5.2, D5.4)
Five CoP reports (functional relations) **(D3.2)**	CoP leaders to draft CoP report June 2020 (M37) Internal review of reports by August 2020 (M39).	CoP leaders to complete

	CoP reports finalised by Sept 2020 (M40).	
Task 3.4: Monitoring and evaluation	WP3 leader draft guidelines, which will be finalised by January 2019.	Monitoring and evaluation guidelines will be integrated with Task 3.1 (i.e. part of LL and CoP methodologies)
	Survey of LL partners: Feb 2019 (M21)	Survey will provide baseline assessment re expectations of the joint learning process (use Likert scales)
	Repeat surveys of LL partners: progress evaluation I (Nov 2019) (M30); progress evaluation II July 2020 (M38)	Repeat surveys re joint learning process, expectations and success criteria
	Draft report on learning processes in LLs / CoPs: September 2020 (M40)	To form chapter in the synthesis report re. learning processes in LLs/CoPs.
Synthesis Report (D3.3)	January 2021 (M44)	WP leaders to complete. LL / CoP inputs to be finalised by M40 for the analysis.

Introduction to the WP3 guidelines (Task 3.1)

The methodological framework for the case studies is elaborated below (Task 3.1), building on the general framework provided in Task 1.3 (conceptual framework). The purpose of the Task 3.1 guidelines is to provide a flexible resource that is structured but not prescriptive, providing partners with a range of options to reflect their circumstances and preferences. The guidelines should be used by research teams as part of a cyclical, iterative, participatory process. They start by introducing key concepts that inform WP3's approach to knowledge creation (epistemology), especially 'living labs' (LL) and 'communities of practice' (CoP). A methodological framework to implement LLs and CoPs in ROBUST is outlined, including monitoring and evaluation of learning processes. Templates for the **LL and CoP Research and Innovation Plans** and for **reporting** (for the place-based and thematic case studies) are also presented to guide the research project and write up of results. A **case study toolbox** of different methods that can be used to foster joint learning between researchers and practitioners (for Task 3.2 and Task 3.3) forms the main component of the guidelines (Appendix 2).

Methodological approach and interaction between Living Labs and Communities of Practice

A number of methodological principles were set out in D1.4 and provide a general guide for the design of the WP3 case study work, as follows:

1. We adopt a **case study approach**;
2. We employ **mixed methods** (as appropriate);
3. The **research is co-produced** by researchers and practice partners and other stakeholders in the case study regions (i.e. transdisciplinary); and
4. The outcomes from the research are **action-orientated** (i.e. not just the creation of scientific knowledge but also informing practitioners and generating practical solutions to problems).

The key concepts from the conceptual framework (D1.1; D1.3; D1.5)[1] are:

- 'New localities' (to understand rural-urban relations),
- 'Smart development' (to understand economic development), and
- 'Network governance' (to understand policy and governance).

WP3 examines these concepts at an empirical level with regard to rural-urban linkages. The WP1 concepts provide a general framework but they can be extended and adapted to reflect the needs and aspirations of practice and research partners.

The **case study approach** is key to how we operationalise WP3. Rather than studying rural-urban relations in general, we have selected 11 specific regions within time and space to examine rural-urban linkages, functional synergies, governance and new approaches to growth and jobs (i.e. grounded). Case studies tend not to use one data generation method and more often employ a number of

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[1] See D1.5 for a useful practice-friendly summary of the three concepts, with supporting examples.

methods (Yin, 1994); they are usually qualitative in nature, but they can also be quantitative or use a mix of both types of data (as per ROBUST).

Two approaches to action-orientated research and social learning shape the design and implementation of the case study work in WP3, namely: **Living Labs (LL)** and **Communities of Practice (CoP)**. Each place-based case study represents a 'living lab', where rural-urban relations and governance arrangements and synergies are examined in relation to three of the five thematic functions: New Business Models and Labour Markets, Public Infrastructure and Social Services, Sustainable Food Systems, Cultural Connections and Ecosystem Services. Common learning emerging in the functional themes is shared across the case studies using the CoP framework (as a learning mechanism). Figure 1 captures this relationship.

Figure 1 - The roles of and relations between Living Labs and Communities of Practice (Source: DoW)
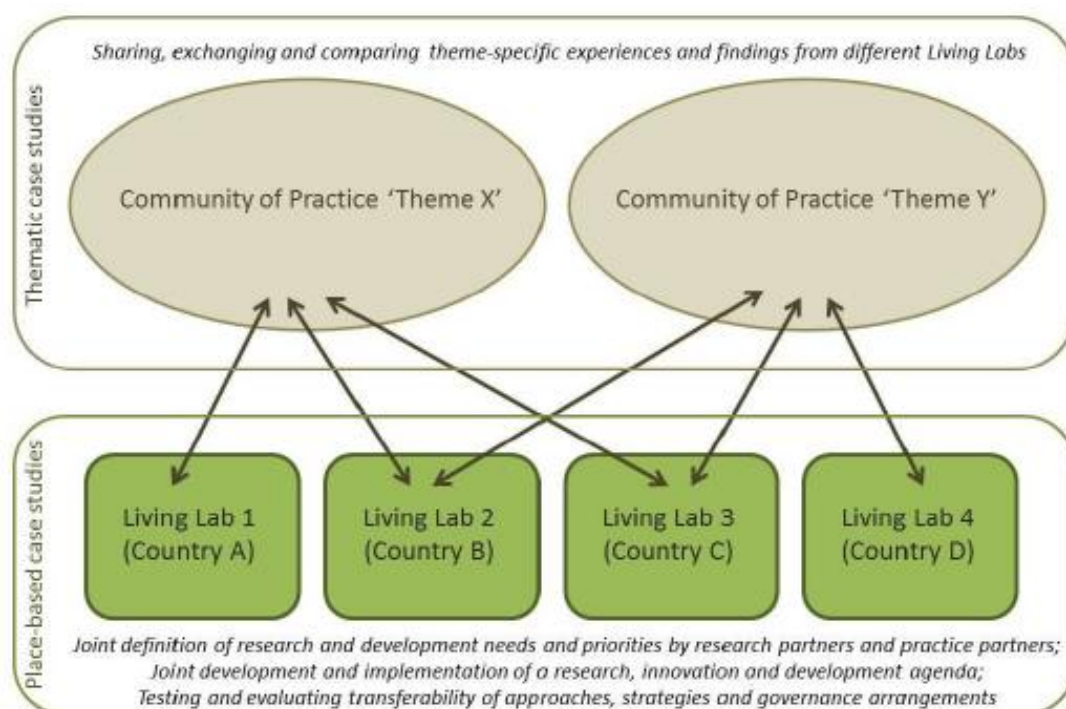
In terms of LL/CoP interaction, **the LL is the entry point** for the case study work in ROBUST; the LL shapes and drives the analysis that takes place in each region. Mutual engagement and collective learning in CoPs supports the work in the LL. Interaction and exchange in CoPs improves developments and supports innovations in the LLs. This is done by enabling the introduction of new perspectives, practices and approaches from other localities into the LL, enriching learning and innovation in the LLs. In each LL the focus is specific, concrete and content focused (captured through a LL motto/ overarching theme – see below).

The level of specificity at a LL-level cannot be achieved at CoP level. Instead, the focus of a CoP is on learning and exchange activities that enable participants to better understand (at a thematic level) how we enhance cross-sectoral cooperation and synergies (WP4) and which governance arrangements can support rural-urban synergies (WP5).

The emphasis on the LL as a mechanism for learning and experimentation draws attention to two other concepts that underpin WP3, namely: '**innovation**' and '**experimentalist governance**'. "Innovation occurs when a new idea (or combination of old ideas) forms a different way of thinking or interacting" (Adams and Hess, 2008: 1). Living Labs have their origin in technological innovation – the development of user-driven ICT systems, for example. In ROBUST we are not excluding technological innovations but we are essentially initiating **social innovation labs**. Social innovation is about changes in social practice (attitude, behaviour, perceptions) and a change in the way society is governed (Bock, 2012; Maye, 2018) leading "to new and improved ways of collaborative action within the group and beyond" (Neumeier, 2012: 55).

The **five functional themes** (Communities of Practice) in ROBUST are quite broad. We focus the analysis through an emphasis on innovative projects, initiatives, institutional arrangements and governance innovations (many identified already through the **WP2 rapid appraisal work**), including what Sabel and Zeitlin (2012) call 'experimentalist governance'. This idea is mostly discussed to date in law and politics (Eckert and Börzel, 2012). Sabel and Zeitlin (2012) use it to reinterpret EU governance frameworks (e.g. the Water Framework Directive) via a process of reporting, peer review and deliberation. The general idea can be extended in ROBUST in terms of experimenting with how it might be possible to change specific governance instruments to improve rural-urban relations.

For ROBUST, LLs thus represent **social innovation labs and experimentalist governance spaces**. Research and practice partners identify governance innovations (which may be 'radical' or 'incremental' – see Appendix 1 for details) that they experiment with in relation to rural-urban relations and synergies (building on innovations already captured in WP2).

The next two sections explain how the LL and CoP elements will be operationalised, including the development of **innovation research agendas**. We then explain processes for monitoring and evaluation (Task 3.4), procedures for reporting and present the case study toolkit.

Living Labs

Living Lab definitions and general characteristics

There is no uniform definition of a living lab. Sometimes they are referred to as partnerships between public, private and civic actors. Universities typically play an important role. They are also defined as pilot and demonstration projects – this reflects their origin in ICT-based development, where they acted as supportive tools for private actors and industry to commercialise services, products and technologies (Voytenko et al., 2016; cf. Steen and van Bueren, 2017; van Geenhuizen, 2018). We adopt the following **definition** for ROBUST:

> "an *arena* (i.e. geographically or institutionally bounded spaces), and … an *approach* for intentional collaborative experimentation of researchers, citizens, companies and local governments" (Voytenko et al., 2016: 46).

Living labs are situated in **real-life contexts** and innovation and the creation of innovative values is implemented by involving actors in a process of **co-creation** and active collaboration (Steen and van

Bueren, 2017: 5). The term **'urban living lab'** is increasingly used in urban sustainability policy. The Joint Programming Initiative Urban Europe (2013) defines these labs as "forums for innovation …[which]… explore, examine, experiment, test and evaluate new ideas, scenarios, processes, systems, concepts and creative solutions in complex and real contexts (JPI Urban Europe, 2013; quoted in Voytenko et al., 2016: 46). In other words, they represent forms of collective urban governance and experimentation. Many of the cited case studies have developed in response to sustainability challenges linked to urbanisation and climate change (Steen and van Bueren, 2017) and include technological and social innovations.

A recent review of "urban living labs (ULL)" experiments in Europe usefully identified **five general characteristics** (*ibid.,* p. 50-51), as follows:

- **Geographical embeddedness**: ULLs are geographically embedded in real places, territorialising innovation at a scale that is manageable and connected, such as the local or district level. This makes it possible to identify and empower discrete sets of actors who can address specific challenges and monitor the effects of their actions. *Bounding ULLs institutionally and geographically* has been shown to create spaces that facilitate innovation (e.g. shared agreements and legal agreements).

  Experimentation and learning: a key focus is experimental approaches to, in this case, governing cities. Experimenting with and testing new policies in real world conditions and visible spaces can potentially prompt radical change. Innovation and learning processes are specified as forms of experimentation (e.g. testing new technologies, ideas, solutions and policies in real world contexts). *User-centred experimentation* is important.

  Participation and user involvement: living labs provide a platform for participation and user involvement. They are based on the quadruple helix model of partnership. In other words, government, industry, the public and academics work together to create innovative solutions. *Participation and co-design* are ideally applied at all stages of the approach, from identifying stakeholder needs, deciding upon goals and visions, planning and designing, to developing, implementing, and evaluating LL actions and updating ambitions.

  Leadership and ownership: from the analysis of ULLs the message is clear that having a leader or owner is crucial. Some projects allocated the central role to local governments. Other projects emphasised *collaboration rather than leadership*, but leadership is still needed. So there is an important coordination and management role for the living lab to be effective, with a delicate balance required between steering and controlling.

- **Evaluation and refinement:** the evaluation of the actions and impacts of a LL is important. This involves collating feedback on the results and *revisiting and refining the goals and visions* over time. Evaluation is important because it facilitates explicit learning amongst the participants, and the refinement of the goals, visions, methods, and needs.

The above characteristics are used to inform the design of the LL methodology for ROBUST. Innovation, including experimentalist governance, co-creation and active collaboration in real-life contexts are defining principles. We can apply these principles in ROBUST to enable forms of collective governance and experimentation that, in this case, address rural-urban linkages and smart growth challenges in European regional territories.

Four stages are outlined below to set up and run a successful LL. The four stages are not always applied in a strict sense, but they provide a useful framework to organise LL work and planning. Monitoring is a key sub-element of evaluation, as an on-going part of the evaluation process. Monitoring and evaluation of the joint learning process starts when the living lab is initiated (see Figure 2). The four stages are interrelated rather than linear, with feedback loops between stages, especially between experimenting and experiencing, which in turn informs reflections on the overall vision and intended outcomes. In other words, there are different pathways to reach successful living lab outcomes (Steen and van Bueren, 2018). Each stage of the LL is described below in more detail.

Figure 2 - Living lab stages for ROBUST, including Monitoring and Evaluation of the joint learning process.

1. Envisioning, Planning & Success Criteria
2. Experimenting
3. Experiencing and Analysing
4. Evaluating, Monitoring and Reflecting

Monitoring
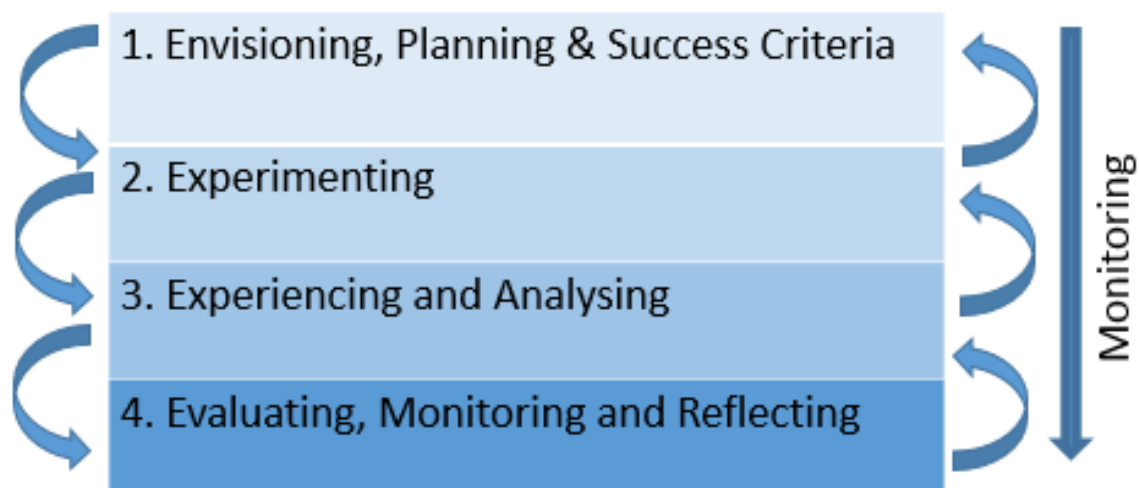
1. **Envisioning, Planning and Identification of Success Criteria**

- Identifying stakeholder needs, developing living lab goals/visions, planning and designing a research and innovation strategy, agreeing on evaluation outcomes (i.e. success criteria).
- Participation and co-design is critical (in this stage and throughout the LL process).
- Important to have a leader/owner, but balance is needed to avoid an overly controlling role. This role is often taken on by the research institute(s) involved in the process but this is not always the case and a more collaborative model is important to consider.
- Research institutes and practice partners work closely together to guide case selection, define visions, and co-design/set up living labs.

2. Experimenting

- In LLs experimentation is about processes of innovation and learning. This can include testing new technologies (traditionally what LLs were about) and ideas/solutions (technical and social) in real world contexts. For example, testing the feasibility of circular economy thinking in Gloucestershire in relation to food waste and procurement contracts, or developing a new approach to territorial planning in Frankfurt.
- The objective is to <u>co-produce knowledge</u> and ideas with users (i.e. user-centred experimentation using methods like focus group meetings, competency groups and participatory scenarios).

3. Experiencing and Analysing

- This stage is closely related to the experimenting stage. The idea is that between the experimentation stage and discussions with users, teams (led by the research partner) will undertake work that captures the innovation(s) as a <u>'lived experience'</u>, collecting and interpreting data linked to the governance experiment. For example, discussions with users about ways to improve water resource management in Gloucestershire (as one thematic strand of the Gloucestershire Living Lab) will be followed up with shadowing work in the water company.
- In other words, this is about deepening the analysis in the case study to further inform the learning/viability of the 'experiment' (e.g. interviews with professionals/regulators in waste management regarding circular economy, opportunities/bottlenecks for change to the system/regulations; trends analysis; collecting opinions; shadowing regulatory officials).
- Important to also analyse the learning data – so analysing the monitoring data, as well as responding to knowledge gaps identified during experimental visits.

4. Evaluating, Monitoring and Reflecting

- Evaluating the living lab actions and reflecting upon / updating the living lab ambitions and goals. As with all stages, this is participatory and co-produced.
- It is important not to leave the evaluation of learning processes to the end of the research cycle. In other words, monitor and analyse the participatory structures, stakeholders, communication and learning processes through the full LL cycle (e.g. collect monitoring data via a short questionnaire at the end of a visit/workshop).
- Important to consider how evaluation can improve living lab activities. Feedback the results and refine visions over time (monitoring data).
- Living labs are more difficult to assess than they appear – having a <u>well-structured monitoring process</u> in place will help overcome this challenge.
- Prepare a final evaluation using monitoring data and final evaluation data (e.g. longitudinal questionnaires) to report on the bottlenecks and opportunities both in terms of content and the learning process. Consider, as part of this, questions linked to refinement and wider dissemination of the innovation (based on the experiences of the lab).

Living Lab themes in the ROBUST project

Each LL is specific, concrete and content focused.

The overarching theme / motto for each is as follows:[2]

- **Ede:** "Further developing and integrating Ede's municipal food, environmental and planning policies by formulating goals and distinguishing key indicators for monitoring its agri-food system and natural capital".
- **Frankfurt:** "Transitioning from quantitative growth and expansion, to qualitative growth and quality of life: the role of regional land use planning".
- **Tukums:** "Developing a cultural strategy for the municipality by identifying key development objectives and priorities".
- **Lisbon:** "Territorial cohesion from within: bridging metropolitan communities and economies for improved urban-rural synergies".
- **Helsinki**: **"**Developing resilient solutions that enable knowledge networks and multiple locations for life, work and entrepreneurship, rural and urban, across the border of Finland (Helsinki) and Estonia (Tallinn)".
- **Lucca:** "Developing a local food policy and a territorial plan to contrast urban-sprawl, steer synergies between the city and the countryside and valorise cultural heritage, landscape and territory".
- **Gloucestershire**: "Assessing the feasibility of a circular economy growth model for Gloucestershire and the potential for synergies and improved rural-urban linkages".
- **Mid Wales**: "Smart growth without an urban hierarchy: polycentric growth beyond the city-region".
- **Ljubljana:** "The possibility of shortening the food supply chain in Ljubljana's Urban Region and its influence on urban and rural quality of life".
- **Metropolitan Area of Styria:** "Shaping vibrant rural–urban-cooperation to foster quality of life through enhanced provision of regional collaboration, in particular in the fields of mobility as a service, innovative business models and cultural activities".
- **Valencia:** "Implementing rural-urban territorial processes in the domains of business, labour markets, public infrastructure and sustainable food systems, shifting from a sectoral and short-term to a more territorial and comprehensive view".

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[2] It is possible that the themes listed below may further evolve in conjunction with the development of the research and innovation agenda.

Below is a template / series of headings to structure the content of the research and innovation agenda to be drafted per living lab. We would like each research/practice partner LL team to prepare a research plan, which should be approximately 2-3 pages in length. The headings and questions are informed by the living lab literature and related principles in order to design and run a successful lab.

The process of identifying and agreeing on an overarching motto/theme for the lab, a research aim and set of objectives and working out how those objectives will be achieved in terms of success criteria, will be instructive and should help to focus the analysis. We have suggested LL teams identify up to three objectives, but this is flexible relative to what each team decides is appropriate for their case.

Try to be *realistic* about outcomes / success criteria given the timeframe and resources. For example, it may not be realistic to change governance regulations or instruments at the end of the experiment. However, it may be possible to use the lab as an opportunity to experiment and test the feasibility of innovative policy solutions in the context of current arrangements. Precise wording is therefore important.

We encourage each living lab research and practice partner team to meet to draft their research and innovation agenda (using the template below). This should take 2-3 hours and can be informed by the analysis of the material already collected from the rapid appraisal exercise (baseline assessment). Some preparatory work to summarise this material is encouraged. From the appraisal work, teams should be able to identify innovative projects and initiatives per functional theme and connections between themes.

By way of example, in Gloucestershire the overarching theme for the LL is 'circular economy'. We want to explore how feasible this circular growth model is for the county and its potential to improve functional synergies and rural-urban connections. We will use the rapid appraisal data and the expertise of our practice partner to identify circular economy innovations in sustainable food (procurement contracts and food waste), ecosystem services (integrated water and soil management) and new business models (for food and services) and to establish a participatory baseline in terms of indicators / success criteria. We will then use the toolkit as a resource to identify appropriate methods and activities that we will need to carry out across the four LL stages. Having identified the problem/innovation and research we move then to the envisioning stage (creating a **shared vision for the lab** with a wider set of stakeholders). At this stage we will revisit the aim/objective and proposed plan and revise if necessary.

As a final general point, teams should also consider and plan for the **two regional workshops** that will be organised as part of WP4 (rural-urban synergies) and Wp5 (governance). Our suggestion is to factor them into the Research and Innovation Plans as important moments in the research process to reflect on the work in relation to each theme. The WP4 and WP5 coordinators will provide specific guidance on each workshop, so at this stage simply consider and factor them into the programme of work.

Living Lab Research and Innovation Agenda – template for completion by Living Lab teams

LL name (e.g. Gloucestershire)	
LL motto / overarching theme	
Research aim / question	
Research Objective 1	
Research Objective 2 (if applicable)	
Research Objective 3 (if applicable)	
What are the innovation/s you are aiming to achieve? e.g. user-centred experimentation, experimentalist forms of governance, innovation activities within / across functions.	
Innovation 1	
Innovation 2 (if applicable)	
Innovation 3 (if applicable)	
How will you know you have achieved your objective/s? (please suggest indicators and success criteria)	
Innovation 1	
Innovation 2 (if applicable)	
Innovation 3 (if applicable)	
At what geographical scale will you be working?	
How do your innovations relate to	

functional rural-urban relations?	
How do your innovations relate to governance arrangements?	

Methods and Evaluation Pathway (please describe the proposed methods to be used for each stage of the living lab, including methods to monitor and evaluate outcomes)

LL stage	Methods
Envisioning	
Experimenting	
Experiencing & Analysing	
Evaluating, Monitoring & Reflecting	

How will user participation be enabled in your work (i.e. co-creation)?

How will the living lab be co-ordinated and managed? i.e. co-ordination, collaboration, leadership

What information / resources do you already have that you can use for the LL?

What information / resources will you need for the LL?

Please provide a timetable / Gantt chart for your LL research plan / planned activities

Stage	Time (months)							
	1 – 3	4 - 6	7 - 9	10 -12	13 -15	16-19	19- 22	22+
Envisioning								
Experimenting								
Experience								
Evaluation								

Communities of Practice

Definition and characteristics

Communities of Practice (CoP) is a conceptual framework which has evolved as a way of thinking about processes of social learning and knowledge generation in groups who are informally bound together by shared values, expertise, interest and practice (for a review see Ingram et al., 2014). The notion of CoP was proposed by Lave and Wenger (1991) and later developed by Wenger (1998) and Wenger et al. (2002). It has been widely used and adapted to describe learning as a social activity in a number of contexts, including: stakeholder management and decision making, participatory planning, and farmer networks (Ingram et al., 2014). Learning is at the core of the CoP concept; CoPs are social learning systems or building blocks of social learning systems (Wenger et al., 2002).

The following **definition** of CoP is adopted for the ROBUST project:

> "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger et al., 2002, p. 4).

CoPs often emerge spontaneously from informal networking among individuals who have similar work-related activities and interests. They are also described as a self-organised group of individuals concerned with a specific practice, who are learning how to improve this practice through regular interaction (Ingram et al., 2014). In CoP theory, learning is social and comes largely from the experience of participating in daily life. As Wenger (1998, p. 45) explains,

> "collectively we participate in activities and engage in them, and over time, this collective learning results in practices that reflect both the pursuit of our enterprises and the attendant social relations. These practices are thus the property of a kind of community created over time by the sustained pursuit of a shared enterprise. As such these kinds of communities are called communities of practice".

Wenger (1998, 2000) traced the link between learning as an act of social participation (situated practice) to three elements of community: mutual engagement, joint enterprise and shared repertoire. CoP members build their community through *mutual engagement*. They come together because they are engaged in actions, the meaning of which they negotiate with one another. Members work together, explicitly or implicitly, to achieve a negotiated common goal (or *'joint enterprise')*, which may or may not officially be defined. CoP members also produce what is called a '*shared repertoire',* or a common history and culture is generated over time by shared practices, language, stories, tools, concepts and repeated interactions (Wenger, 1998).

Criticisms have been voiced about the extensive use of the term CoP and the 'dilution' of the concept. For example, understandings of what constitutes CoP have become increasingly flexible. Nevertheless, the core practices described above remain central to the concept and they can be usefully applied to help design how we implement the CoPs in the ROBUST project.

The ROBUST project uses the social learning characteristics identified by Wenger (1998, 2000) as a heuristic framework to design the CoP methodology. In other words, learning is an act of social participation (situated practice).

For ROBUST this means that each CoP focuses on learning and exchange activities that enable participants to better understand (at a thematic level) how we enhance cross-sectoral cooperation and synergies (WP4) and identify governance arrangements that can support rural-urban synergies (WP5). This focus on points of common learning complements the LL work, where specificity/contextual learning is emphasised.

We suggest that the CoP research action plans are structured according to the three elements of community (or at least use the three elements as conceptual inspiration to guide and rationalise their planning and future work – see the CoP Innovation Template for further details):

- **Joint enterprise**. Members work together, explicitly or implicitly, to achieve a negotiated common goal or joint enterprise, which may or may not officially be defined. The research plan identifies joint enterprise through a set of common goals.

- **Mutual engagement**. CoP members build community through mutual engagement. They come together because they are engaged in actions, the meaning of which they negotiate with one another. The research plan outlines how mutual engagement will be developed (i.e. communication).

- **Shared repertoire**. CoP members produce a shared repertoire, a common history and culture, which is generated over time by shared practices, language, stories, tools, concepts and repeated interactions (Wenger 1998). The research plan outlines how each CoP will develop collective learning resources (reification).

CoP Research and Innovation Agenda – template for CoP co-ordinators

CoP theme e.g. ESS	
CoP coordinator and members	

Developing joint enterprise. Summarise the procedures for and scoping of common goals / issues the CoP will collectively work on, the common learning and matching themes so far identified and the agreed aim/ambitions of the CoP. (This work should be complete after two project meetings).
Developing mutual engagement. How will the CoP communicate/share learning? Describe agreed plans to communicate as a group; provide a timeline of activities (face-to-face and virtual meetings)
Developing shared repertoire. What resources will be needed to create a shared repertoire? Methods to be employed for sharing research. For example, the development of evidence papers, creating a resource library, the drafting/agreement of joint meeting minutes …
Evidencing learning and assessment. How will learning be monitored in the CoP? What methods will you use and when will learning be monitored? What methods will you use for knowledge exchange/brokerage? Will learning experiences be shared within the group? E.g. discuss the effectiveness of the CoP at a face-to-face meeting and modify plans, if necessary.
How does the CoP work inform ROBUST re functional rural-urban relations? Key theme/s explored; common indicators to develop/test, etc.
How does the CoP work inform ROBUST re governance arrangements? Key theme/s explored; common indicators to develop/test, etc.
How does the CoP work inform ROBUST re new growth models? Key theme/s explored; common indicators to develop/test, etc.

CoP Research and Innovation Agenda – template for CoP co-ordinators

Monitoring and evaluation framework

This section outlines the monitoring and evaluation framework that has been developed for WP3. Over recent years, evaluations have become an increasingly important means by which to justify the public funding of initiatives and wider programmes of support. Although there is broad agreement as to the main functions of evaluations, there is widespread debate about how they should be conducted in practice and the relative emphasis that should be given to the different types of data gathered. The key debate in this respect is between more positivist, technical-rational models that assume an objective assessment is possible, and those that argue for the need to acknowledge greater complexity, uncertainty, subjectivity and context specificity. In the latter case, the approach is more deliberative, with an emphasis on inclusivity and recognition of the validity of a wider range of voices and perspectives in defining legitimacy (Owens et al., 2004, United Nations, 2014, Funtowicz and Ravetz, 1993).

The approach taken in the ROBUST project follows the principles of **'Participatory Assessment, Monitoring and Evaluation' (PAME)** (see FAO, 1989). A key focus of the PAME approach to evaluation is that those involved at the delivery end of projects decide what it is they want to do and how they want to do it; in other words, it is they who are ultimately in the best position to decide whether or not a project has been a success. As part of this process, it is important to ensure that there is an active dialogue between those monitoring and evaluating a project and those who are responsible for delivering it. In the case of ROBUST, between the practitioner and academic teams. In this respect, there is no 'them and us', but rather a 'we', as partners, in terms of delivering a project. It is the PAME approach to monitoring and evaluation that is paramount, whereby whatever the tools used to gather data need to encourage participation and dialogue.

A key aspect of any monitoring and evaluation process is the determination of a **suitable baseline**(s), mainly as a means of establishing a benchmark against which to measure change, but also as a means of establishing priorities. As part of this, it is also necessary to establish a set of indicators as a means of gauging progress. Indicators need to be chosen that are suitable for the project being monitored and evaluated, but are likely to include those that assess the *relevance* of an activity to the aims of the project; the *resources* that have been invested; the *efficiency* with which the resources have been used in achieving the objectives; the *coverage* or scope of the project, in relation to the targets set; and the *qualities* or standard of the outputs from the project in terms of both the aims of the project, but also the longevity of the process.

The process also needs to be ongoing, whereby the monitoring enables constructive feedback to the ongoing development / delivery of the project. For example: to what extent is progress being made in relation to the aims of the project; does anything need to be done differently; are the aims and objectives still achievable, or do they need to be re-assessed; are there any negative implications that were not considered at the outset; and so on. This necessitates establishing what will be monitored; how it will be monitored; who will monitor it; when it will be monitored; and finally, what tools will be used to undertake the monitoring process. Likewise, it is necessary to decide when the final evaluation of the project will be done, as well as identifying the availability of suitable resources such as time, people, data, and the choice of appropriate tools (FAO, 1989).

As such, following the principles of **PAME**, the research-practice partner teams in each living lab, as well as the participants in each community of practice, will determine what is specifically to be evaluated, as well as decide on the criteria to be monitored and evaluated, themselves. **Success criteria** encompass the broad categories of **process, context and outcomes**. The purpose for doing this is to be able to assess the nature of rural-urban relations and, in particular, the synergies identified – both actual and potential – as well as the potentials and bottlenecks for enhancing rural-urban linkages and enhancing mutually beneficial relations between rural, peri-urban and urban areas. Key to this is the monitoring and evaluation of the multi-actor joint learning process, which forms the basis of the ROBUST methodology.

The following steps will be implemented to monitor and evaluate learning in ROBUST:

LLs:

- **Baseline (m21) and repeat surveys (m30, m40)** of living lab research / practice partners. These will provide a longitudinal dataset to identify expectations and compare those expectations with final outcomes across the 11 living labs. Surveys will be developed by UoG and PRAC.
- **Three monitoring surveys per living lab** (roughly 5 months apart and, if possible, at the start/end of key phases of each lab). Living lab teams are responsible for collecting monitoring data from participants involved in the living lab as part of their innovation plan. Research teams can use basic questionnaires or other suitable methods in the toolkit. UoG / PRAC will develop basic questionnaires / monitoring templates to share with teams (as a guide).

CoPs:

- The CoP is a form of 'second order' learning (Wenger 1998), which means monitoring and learning is captured through **participation** and **reification** (generated by implementing the CoP plans).
- **Monitoring data** should be collected via online surveys, face-to-face feedback at reflective workshops, etc.
- In terms of **longitudinal data**, coordinators are encouraged to organise an <u>expectations exercise</u> early in the CoP cycle, which can be followed up with an <u>outcomes exercise</u> at the end of the learning cycle. CoPs will also evaluate the usefulness of the methods proposed in the case study toolkit.

Analysis of socio-economic development and common indicators or 'statements of success':

- Following PAME, the idea is that each LL / CoP determines what is to be evaluated and success criteria (i.e. context, learning and outcome indicators that are targeted).
- However, bearing in mind that the LLs and CoPs need to inform WP4 (rural-urban synergies) and WP5 (governance), and at the end of the project we also want to say something new and novel about jobs and growth models, it will be important to develop (led by the WP leader of the appropriate work package), common indicators or 'statements of success' (as defined by the practitioners) that can be used as a resource for the LLs/CoPs.
- In Annex 3 PRAC has provided a **simplified method for the analysis of socio-economic development** in terms of rural-urban linkages. This paper sets out a spatial econometric procedure (e.g. using micro-spatial commuter data) to examine rural-urban relations. The methodology will be 'experimented' and 'tested' by three or four LLs (the LLs that will test this approach will be decided by the end of 2018 – led by the PRAC team). In the WP3 toolkit a summary sheet for participatory spatial econometrics is also included for partners who wish to experiment with this approach to examine socio-economic development.

- A separate paper (also led by PRAC) will develop a second complementary approach to socio-economic development. This paper will capture recent debates about **new de/growth models and quality of life**. This paper will develop common indicators to examine, for example, quality of life outcomes. This paper will be developed in early 2019 and updated as the LL and CoP work progresses. It will be a common resource for all LLs/CoPs to use.
- We can identify common indicators or 'statements of success' at four levels: i. new growth models / forms of socio-economic development; ii. rural-urban synergies; iii. governance; and iv. learning processes / social innovation. This means that additional indicators for rural-urban synergies, governance and learning processes may also be required. They will be developed in consultation with the WP4 and WP5 leads and if appropriate incorporated into the new growth models paper (or developed in a separate paper).
- At a CoP level, once teams identify common learning / matches consideration should be given to identifying common indicators. In the new business model CoP, for example, sustainable welfare is of potential interest. This requires the development of novel indicators that extend traditional indicators of economic growth (GDP, population, employment growth – see van Leeuwen, 2015).

Case study toolkit

Creating Pathways of Evaluation

The case study toolkit is presented below. The ROBUST toolkit below lists a range of methods, details how they might be implemented and provides a summary of key benefits and needs (per method). The LL is participatory, so the purpose here is not to be prescriptive, but to provide suggestions for how the tools might be used (as a resource listing novel and more established methods that can be combined to enable co-learning and co-innovation relative to the interests and ambitions of each lab).

The toolkit is not exhaustive. There are other methods that could be included, including some which are similar to those listed but use another name. That said, we have endeavoured to provide a good coverage across the LL stages. Partners may also wish to consult other additional relevant toolkits e.g. http://www.designkit.org/methods (accessed 13.11.18) and https://naturalsciences.ch/topics/co-producing_knowledge/methods (accessed 13.11.18). If partners consult other toolkits and find methods useful it will be important to share this information with the project team and CoP leaders (the ROBUST toolkit can be updated and modified over time).

Methods selected in the research and innovation plan should align with your LL, allowing you to achieve your goals in the ways in which you want the process to proceed. Research partners will be able to help with some specialist skills. In some instances, you can adapt a method to reflect the time or resources you have to invest. For example, we have included 'Participatory GIS Mapping', but partners may wish to proceed with printed maps, transparent overlays and coloured pens. Similarly, 'Material Flow Analysis' can be very quantitative and complex, but for some simple systems and intended purposes less data might be sufficient.

Table 3 presents a brief assessment of the participatory methods listed in the toolkit. Partners are encouraged to add more Pros / Needs where they have experiences of particular methods.

Table 3 - The Advantages and Needs of Participatory Methods

Method	Pros	Needs
Stakeholder Mapping	Easy to achieve & participatory.	At most simple paper & pens.
Material Flow Analysis	Detailed information about the sustainability of systems.	High information requirements.
Participatory GIS Mapping	People-orientated maps & connections.	Knowledge of GIS systems.
Competency Groups	Detailed & rich co-produced outcomes.	Facilitation & buy-in by all participants.
Participant Observation	Useful insights into behaviours and experiences.	Role of the researcher needs to be agreed by participants.
Shadowing & placements	Detailed information of lived experience.	Requires a lot of time & access will need to be negotiated.
Participatory Scenario Building	Create a shared strategy for the future.	Needs to balance the difficulties of the process against uses / application.
Role-playing	Allows everyone to engage & experiment.	Needs preparation & all participants to be present.
Evaluation Questionnaires	Easily administered & widely understood.	Questions need to be carefully worded.
Webinar/on-line forums	Convenient discussion & virtual interaction.	Moderation & appropriate software.
Systemic Evidence Review	Rigorous assessment of evidence.	High information requirements.
Storywall	Participatory assessment of a process.	Facilitation & some graphical skills.
Social Network Analysis	Powerful way of visualising and measuring connections.	Requires some expertise to implement.
Joint Visioning	Creation of shared ways towards solutions.	Requires trust & imagination from participants.
Foresight Analysis	A way of joint visioning within a network.	Best suited to a unified network or organisation.
Scenario Building	Useful when the past/present not a guide to the future.	Aim to have one final scenario not multiple ones.

Method	Pros	Needs
Concept Mapping	A graphical way of synthesising ideas for the group.	At its most simple uses only pen & paper, but structure needs time and planning.
Mind Mapping	A graphical way of exploring the ideas of the group.	Can be a simple technique, quickly achieved.
Systems Mapping	A graphical way of exploring a system.	Needs to be established that a system is in place.
Pairing of researchers & policy makers	A way of sharing information between organisations.	The purpose of the pairing needs to be apparent to the wider organisations.
Appreciative Inquiry	Fosters positive relationships & solutions.	Criticised for not fostering learning.
Story Telling	Uses tacit knowledge to build shared understandings.	Less useful for exchanging information, requires a timely use.
Focus Groups	A group interview that has low barriers for participation.	Requires careful moderation, and analysing the results takes time.
Charrette	A group of focus groups that discuss a common topic. Useful to bring together multiple stakeholders for creative and collaborative problem-solving.	Need care preparation for a successful charrette, including pre- and post-charrette steps to agree the main focus and report agreed outcomes.
Expert Interview	A group interview which makes use of experts' knowledge quickly.	Requires facilitation & small groups.
Force Field Analysis	Useful way of considering the forces blocking a solution.	Can consider only one 'event' rather than continual reflection.
Knowledge Cafe	A powerful way of gathering tacit knowledge in an informal setting.	Requires facilitation & a positive setting.
World Cafe	A quick way of collating knowledge rather than generating it.	Requires facilitation skills & takes time to share.
Marketplace/Poster Exhibition	Encourages dialogue & discussion.	Participants need to prepare posters & exhibitions.
Social Return on Investment	Creates a narrative of change & its value, focused on outcomes.	Can be a complex process & requires expertise to develop indicators.

As well as considering the individual methods listed in the toolkit it is important to consider which method would be appropriate at which stage of the living lab and how these might interact, to achieve the LL goals and produce data will be helpful for monitoring and evaluation of learning. We have created below three fictitious evaluation pathways (Table 4), to illustrate how the methods in the toolkit can potentially be utilised depending on the desired outcomes. ***Please note that the intention in the examples below is <u>not</u> that partners should pick a red, green or yellow pathway – the examples below simply provide different ways of how one <u>might</u> develop an evaluation pathway.***

Examples of evaluation pathways

- **Evaluation Pathway Example 1**. In the first example the LL considered the flows of materials through a municipal recycling scheme. The aim of the LL was to experiment with, test and expand the range of materials that are recycled. The LL started by **mapping the stakeholders** involved in the scheme, those who could be part of the scheme and those who were important to the scheme's current operation to better understand the actors, their relationship to one another, and how decisions are made. Then they modelled what was recycled in the community through a **material flows analysis**. Meetings with stakeholders included **on-line webinar and face to face meetings/interviews** to reflect on the outputs produced and brainstorm how to expand the range of materials recycled. The LL concluded by conducting a **storywall** exercise to evaluate how participants experienced the process and document their goals and actions for the future, supported by monitoring questionnaires and regional workshops. The **material flows analysis** was important as the LL needed quantitative data to report to policy partners and to provide legitimacy for the process.

- **Evaluation Pathway Example 2**. In the second example the LL experimented with the development of a cycle path transport system for villages and towns using shared cargo and electric bicycles. In order to understand the problems in the current system, participants worked to plot their communities and the journeys made using **participatory GIS mapping**. The lab then created a **competency group**, mixing technical expertise, local authority officers, community representatives and transport users to share knowledge and develop solutions. The LL used these methods because it needed to work with existing transport providers and users in order to integrate with the existing provision of cycle paths. Researchers also worked in individual organisations to observe the opportunities and blockages in greater depth (**shadowing and placements**). An **evaluation questionnaire** was used to understand how practical the final recommendations of the LL were and what participants valued in the process; the regional workshops for WP4 and WP5 were also used to further reflect and evaluate the outcomes.

- **Evaluation Pathway Example 3**. Participants in the third example were interested in how to provide better care provision for elderly people with complex needs in rural areas. They used **participatory scenario building** with elderly people, their families and healthcare professionals to envisage a better system of support. A **systemic evidence review** was undertaken to ascertain the clinical and organisational knowledge about the systems. The results were used to create a model for a new system, and participants in the LL were asked through **role play** to imagine how they

might use the system, playing the role of different people in the new system. The LL concluded with a **participatory scenario building** exercise to refine the proposals and envisage how the new system might respond to changes, including new technologies, as well as organising regional workshops (as part of WP4 and WP5).

The examples presented here are designed as hypothetical examples to show how the methods might be structured so LLs can achieve their aims. Each living lab will develop their own combination of methods and for the ROBUST project it is likely that teams may use more than one or two methods in each stage. Crucially, it is important to plan how they will be used to optimum effect and to match the expected aims, objectives and outcomes of the lab.

Table 4 – Creating evaluation 'pathways' with combinations of methods (fictional examples).

LL stage	**Evaluation Pathway 1**	**Evaluation Pathway 2**	**Evaluation Pathway 3**
Envisioning	Stakeholder mapping	Participatory GIS mapping	Participatory scenario building
Experimenting	Material flow analysis	Competency groups and observations	Systemic evidence review
Experiencing & Analysing	Webinar /on-line forums; interviews	Shadowing & placements	Role playing
Evaluating, Monitoring & Reflecting	Storywall; monitoring questionnaires; regional workshops (WP4, WP5)	Evaluation questionnaire; regional workshops (WP4, WP5)	Participatory scenario building; regional workshops (WP4, WP5)

To help research teams select appropriate methods for their LL/CoP, Table 5 summarises the stage(s) each method listed can be most effectively applied. This is an indicative guide. The toolkit of methods is presented in Appendix 2, with a summary page for each tool/method reviewed.

Table 5 - Methods and tools for LLs and CoPs, including monitoring and evaluation

Tool / Method	Purpose and application re LL stages			
	Envisioning	**Experimenting**	**Experiencing**	**Evaluating and monitoring**
Stakeholder Mapping	X			
Material Flow Analysis		X	X	
Participatory GIS Mapping	X			
Competency Groups		X	X	
Participant Observation		X	X	
Shadowing & placements		X	X	
Participatory Scenario Building	X			X
Role-playing	X		X	X
Evaluation Questionnaires			X	X
Webinar/on-line forums	X	X	X	X
Systemic Evidence Review		X		
Storywall				X
Social Network Analysis		X	X	
Joint Visioning	X		X	
Foresight Analysis	X			X
Scenario Building	X			X
Concept Mapping	X			
Mind Mapping	X			
Systems Mapping		X		
Pairing researchers & policy makers		X	X	
Appreciative Inquiry		X	X	X
Story Telling	X			
Focus Groups	X	X		
Charrette	X	X	X	
Expert Interview		X		
Force Field Analysis			X	
Knowledge Cafe	X			X
World Cafe	X			X
Marketplace/Poster Exhibition	X			X
Social Return on Investment		X	X	

Reporting template: Living Labs

Below is a basic template to report the living lab work, using the four living lab stages as a basic organising framework. Please note that the template proposed here may well evolve as discussion and living lab work develops in the next two years.

1. Living lab introduction and context

- Context for the living lab
- Aim of the lab, origin of the idea/motivation for the lab and transformative potential (relative to status quo and wider policy context e.g. national or regional growth policies, rural and urban development policy)
- Report aim and structure

2. Living lab methodology / approach

- How the work was planned / implemented in line with the four stages (e.g. what was the process like? What actors and at what level (regional, city-region, etc.) were involved at each stage?)
- Procedures for co-creation and monitoring
- Identification of success criteria, etc.

3. Analysis of the Living Lab stages

- Envisioning: describe how the vision was created / negotiated …
- Experimentation and lived experience: describe the experiment, transition phases and analysis of data re rural-urban flows, governance arrangements, the potential as an enabler of change, success factors, opportunities and bottlenecks, etc.
- Evaluation and monitoring: how successful was the experiment (did the lab meet the outcomes / success criteria set at the start, for example), feedback from the monitoring process and adjustments made to the intended outcomes, unintended outcomes, coordination and leadership of the lab, etc.

4. Implications for rural-urban governance and innovation

- What are the implications of the data in terms of rural urban linkages?
- What are the implications in terms of governance?
- What are the implications in terms of new growth models and smart development?
- Methodological reflections re experimentalist governance and social innovation e.g. lessons learned for other places/experiments; contextualisation of lessons; possibilities for replication and dissemination

5. Conclusion

6. References

7. Appendices

- Include key research materials and summary data from the living lab sessions, etc.

Reporting template: Communities of Practice

Below is a basic template to report the CoP work, using the three CoP characteristics as a basic organising framework. Please note that the template proposed here may well evolve as discussion and CoP work develops in the next two years.

1**. Introduction**

- Overview of the functional theme
- Aim of the CoP
- Co-ordination and management of the CoP
- Report aim and structure

2. The research process and learning cycle

- Composition of the CoP
- Timeline of activities / meetings and document interactions (real and virtual)
- Processes for communication / knowledge exchange / learning

3. CoP themes and common learning

- Summary of scoping and identification of common issues, indicators and matching (joint enterprise)
- Summary of the main results for ROBUST
    - o Common learning re rural-urban linkages /synergies
    - o Common learning re governance
    - o Common learning re new growth models

    [materials can be analysed from webinars, face-to-fact meetings, evidence papers, etc.]

4. Monitoring and evaluation of learning

- Summary of key data and findings in terms of:
    - i) assessment of the methods used and the usefulness / limitations of the toolkit;
    - ii) the facilitation process (what worked / did not); and
    - iii) evidence of learning processes via the CoP (summary of monitoring and evaluation data collected)

5. Conclusion

- Key messages from the CoP re ROBUST themes: rural-urban linages and governance; what lessons / innovations have most potential to be translated; opportunities and bottlenecks, etc.

6. References

7. Annexes

- Minutes from CoP meetings (real and virtual); summary tables of shared goals, etc.

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Appendix 1: The scale and scope of social innovation (Marques et al., 2018)

Table 1. Definitions of social innovation according to the scale and scope of change that they encapsulate.

Scale and scope of change	Examples	Relevant articles
Structural SI	Innovation in social institutions or relationships as a result of wide political/social/economic change	(Godin, 2012; Grimm et al., 2013; Henderson, 1993; Jessop et al., 2013)
Targeted radical SI	Activities that radically reshape how essential goods and services are delivered to improve welfare and that challenge power relations	(Gerometta et al., 2005; Membretti, 2007; Moulaert and Nussbaumer, 2005; Moulaert et al., 2005; Scott-Cato and Hillier, 2010; Seyfang and Haxeltine, 2012; Vaiou and Kalandides, 2016; van der Schoor et al., 2016)
Targeted complementary SI	New processes and relationships that can generate inclusive solutions to societal challenges	(De Muro et al., 2007; Garcia and Haddock, 2016; Han et al., 2014; Novy and Leubolt, 2005; Parente, 2016; Prasad, 2016; Semprebon and Haddock, 2016)
Instrumental SI	Rebranding of political agendas, community development, corporate social responsibility	(Foster et al., 2016; Gershuny, 1982; Goldsmith et al., 2010; Graddy-Reed and Feldman, 2015; Nordensvard et al., 2015)

Source: Authors' research based on literature review.

Appendix 2: Methods and Tools: Summary Fiches

Stakeholder mapping (also called Chapatti mapping)	
Introduction	A stakeholder map, often associated with business and organizational studies, is a visual representation showing the relative positions of the stakeholders in a specific organization or institution and at particular times. Stakeholders can be characterized as *internal* where they are directly involved in operating, ownership of, or governing the organization, or using its goods/services. *External* stakeholders (e.g. advisors, experts) may also influence the direction of the organization. Stakeholder mapping can be a useful technique for delineating and comparing different types of association with an organization, for identifying multiple roles (e.g. employee, board member, investor, user), or examining the power/influence of different stakeholders. A visualisation of stakeholders in relation to their respective roles might be useful when considering the efficiency of stakeholder networks, the relative ability of stakeholders to influence actions, the numbers of stakeholders concerned with particular roles, or specificities such as the gender or status of stakeholders.
Purpose	Stakeholder mapping provides an inventory of stakeholders which can inform social change and policy development processes. Stakeholder mapping makes it possible to determine the distinctive, or multiple roles played by different stakeholders, as well as the number of stakeholders engaged in particular roles.
Procedure	Start by identifying the context in which your stakeholders will be visualised. For example, is the purpose to identify members of a stakeholder network depending on their function? Or are you trying to determine who might be most effective in levering change? If policy change is the ultimate goal, how might a stakeholder map identify coalitions to drive change? Generally, the following steps will be important: • Identifying and describing your stakeholder group and their (internal and external) roles (e.g. a regional development organisation, a company, a community group etc.) • Determining the purpose of your analysis (e.g. functional, relational, qualitative and/or quantitative engagement etc.) • Creating a simple typology of stakeholders – how are stakeholders grouped? (e.g. owners, employees, board members, users, customers, managers, advisors, investors etc.) • Survey the individual stakeholders in the network and identify the relationships between them. Two stakeholder mapping techniques include: • Venn diagrams shows overlaps or groupings between stakeholder functions and their number (see Scharma 2003); • Quadrant/chapatti mapping allows the degree of (e.g.) influence, value or knowledge of stakeholders to be compared. This might position stakeholders in quadrants depending on the regularity of their engagement in an organization. Other techniques positioning stakeholders in quadrants as relatively sized circles (also known as chapattis, after the Indian flatbreads), and connected by directional arrows. A large circle with a monodirectional arrow to a small circle signifies influence by one stakeholder over another (see BSR website below).
Resources	Due to the importance of identifying the purpose of the research, it will be advantageous to research a number of techniques in advance. Templates for project quadrant mapping https://www.smartsheet.com/what-stakeholder-analysis-and-mapping-and-how-do-you-do-it-effectively#getting-started-with-stakeholder-analysis-and-mapping Detailed exemplar briefings and case studies of stakeholder mapping at: https://www.ids.ac.uk/files/dmfile/StakeholderMappingExercise-briefforfacilitators.pdf
Tips	Usually, stakeholder mapping will visually identify stakeholder dynamics within an established organizational framework and within a particular time period. In that sense it reflects the contemporary

	status quo rather than offering predictive insights. Mapping is influenced by the intentions of the investigator and a clear idea of the criteria for grouping stakeholders in the map is needed.
Further information	Sharma, P. (2003) Surveying the individuals in the network to identify the relationships and knowledge flows between them. *2003-01 MOB. School of Business and Economics*. Wilfrid Laurier University, Wellington.
	Examples of quadrant and chapatti mapping at:
	https://www.bsr.org/reports/BSR_Stakeholder_Engagement_Stakeholder_Mapping.final.pdf
	https://www.weadapt.org/knowledge-base/transforming-governance/stakeholder-identification
	Aligica, P.D. (2006) Institutional and Stakeholder Mapping: Frameworks for Policy Analysis and Institutional Change. Public Organization Review 6: 79–90.

Material flow analysis	
Introduction	Material flow analysis (MFA) can be a useful tool in circular economy approaches because it counts input and outputs within a process or place, usually in terms of physical units. Examples of MFA could include the amount of resource inputs required by a factory for its manufacturing operations compared to its subsequent productive output. MFA can also be applied at a spatial level, for instance when considering the amount of food produced in a region, the input requirements for this, and the resources used in importing food into the region. In planning, MFA has been used as a way to calculate spatial metabolisms, for example the flow of water, nutrients, material resources in relation to the output of waste, CO_2 etc. in cities.
Purpose	Material flow analysis is a way to quantify (and/or assign actual or proxy cost to) the flow of materials through a specified system. As a measure of industrial or social metabolism it is used in green accounting.
Procedure	It is important begin MFA by designing a systems boundary, in order to specify what processes will and won't be included in the analysis. Further procedures should be researched in relation to the contexts of analysis (see examples below).
Resources	STAN (short for subSTance flow ANalysis) is free software designed to help structure MFA for waste management and provided by the Technical University in Vienna. A handbook of MFA can also be accessed https://iwr.tuwien.ac.at/ressourcen/mfa-handbook/download-software/
Tips	MFA can be very data intense and will not work unless relevant data is available.
Further information	A useful overview appears in Wikipedia: https://en.wikipedia.org/wiki/Material_flow_analysis MFA is covered in the following chapter of Bartelmus and Seifert's (2003) book *Green Accounting* https://www.taylorfrancis.com/books/e/9781351770835/chapters/10.4324%2F9781315197715-6 This paper in *Local Environment* outlines how MFA is used in urban environmental policy making in Switzerland and Austria https://www.tandfonline.com/doi/abs/10.1080/13549830050134257 This paper in *Environmental Pollution* considers material flows as part of urban metabolism https://www.sciencedirect.com/science/article/pii/S0269749110004781

Participatory GIS mapping	
Introduction	PGIS is a participatory way of collecting and managing spatial data. It covers a wide spectrum of levels of stakeholder involvement. This may range from entirely bottom-up approaches which serve the objectives of civil society groups, or it may be guided by top-down policy priorities. PGIS emerged as a response to criticisms (discussed by Sieber (2006), see below) that GIS had become too exclusive: a technology that essentially controlled rather than disseminated knowledge produced and held by the government sector. This was, initially, linked to the expense of early GIS equipment. Different formats of PGIS include Public Participation GIS (PPGIS), Community Integrated GIS (CiGIS) and Volunteered Graphic Information (VGI). PGIS has been widely used in rural development in the global south.
Purpose	PGIS covers a range of methods of experimental co-production and analysis of knowledge, integrating GIS technology with local expertise and experience. Its applications include public consultation on proposed policies, capturing and applying indigenous knowledge in community and spatial planning, and encouraging public participation in GIS data sharing (a format of citizen science).
Procedure	The nature of participation needs to be considered before work begins. For example, is the PGIS work to be entirely led by local people, or will parties have particular tasks to perform (e.g. gathering and/or reviewing data), or will the PGIS constitute a process of publicizing decision-making processes?
	Choices about PGIS procedures depend upon the way GIS data is to be produced. As an example, the procedure below sets out how local knowledge can inform spatial data sets on agriculture:
	• Convene a meeting between the agri-environmental service, GIS researchers and an appropriate network of local practitioners (farmers). In PGIS, this group is called a Community of Practice.
	• Land use/soil/habitat maps, aerial photographs, satellite images etc. can be presented to show how official data on local agriculture is represented.
	• Discussion with participants may reveal divergence in official and local knowledge of soil quality, or experience of prevailing weather patterns that affect production decisions. Several meetings may be needed to gather the data required.
	• Data can be captured into GIS software to produce maps with improved accuracy which diminish official and local divergence in knowledge, and to discuss future opportunities linked to, or by adapting, agri-environmental support measures.
Resources	A factsheet on the PGIS method in relation to ecosystems services has been prepared via the FP7 project *Openness* https://oppla.eu/sites/default/files/uploads/methodfactsheetpgis.pdf
Tips	A trained/skilled facilitator is helpful.
	A working knowledge of GIS will be needed not just for developing spatial models, but also for interpreting and entering geographical data into the software, based on the outcome of the discussion. It may be necessary to offer basic training in GIS if modifications are to be made as part of the discussion.
Further information	For an overview and general introduction to public participation GIS, see Sieber, R (2006) Public Participation Geographic Information Systems: A Literature Review and Framework. Annals of the Association of American Geographers 96(3): 491-507.
	https://dusk.geo.orst.edu/virtual/2007/sieber2006.pdf

Competency Groups	
Introduction	Competency groups form an experimental methodology in which local people, technical experts (such as civil servants) and scientists come together to exchange local knowledge and expert experience in order to find practical solutions to local challenges. In the UK competency groups were piloted through the RELU programme (see further information, below). Because competency groups try to solve problems experimentally by applying multiple types of knowledge, they present opportunities in ROBUST (mini Living Labs?).
Purpose	Competency groups help to fill gaps in scientific knowledge by drawing on local knowledge and lived experience. A feature of them is that all knowledge – scientific and lay – is taken equally seriously and that group members are united in their ambition to inform practice. In short, competency groups improve the process of generating science through the inclusion of local knowledge.
Procedure	Once the subject matter of the group is identified (e.g. in Robust this might include rural housing policy, or decisions to invest in tourism development, as well as environmental questions), a group will need to be convened.
	This should be small enough for constructive and focused discussion to be shared and large enough for expert and local knowledge to offer a breadth of insights into the issue for discussion. Around 6-12 people is manageable. Ideally competency groups should meet frequently for short periods, in order that a sense of progression is discernable. Once a month or so, for the period of investigation, might be viable.
	An effective facilitator will be helpful in ensuring that every member of the group is heard and that contributions are focused on the subject matter under discussion.
	If the competency group is discussing the effects of existing policy on a challenge, the group should consider the evidence base, and other (e.g. political, historical) contexts which led to the development of the policy. Questions can include: is there any visibility of scientific evidence in the policy? Does recent evidence indicate the need to adjust policy? How does evidence compare to the knowledge held by local people? Has local knowledge and experience been considered or ignored in the process of building of the evidence base that led to the policy? How can adjustments be made in future?
	Next, models or maps can be developed which apply alternative visualisations of what would happen if policy and practices where changed on the basis of the competency group discussion. Competency group instigators will need to consider the ability of group members to understand and navigate any IT software and offer initial training, if necessary. It may be helpful to the visualization process if visits are made to places, institutions or organisations being discussed
	Sets of recommendations of future action can be articulated and presented to local policy makers at the end of the process and form an action plan for interventions which can be taken up by civil society groups.
Resources	This website gives an overview the nature and application of environmental competency groups. https://www.environmentalcompetencygroups.org/
Tips	Local people may need to be persuaded that giving up their time to contribute to experimental competency groups is worthwhile. Therefore, clear objectives and realistic outcomes must be drawn up and understood. Similarly, ensuring that experts (some of whom may also be local residents) speak freely and without institutional inhibitions or inhibitions, requires thought to be given to confidentiality.
Further information	Whatmore's paper on competency groups and knowledge controversies is useful background reading and features a discussion linked to flooding:

Whatmore, S. (2009) Mapping knowledge controversies:

science, democracy and the redistribution of expertise. *Progress in Human Geography* 33(5):587-598.

Reflections on environmental competency groups which were part of a RELU project are shared here: http://knowledge-controversies.ouce.ox.ac.uk/competencygroups/

This book gives examples of community-led creative mapping:

Clifford, S and King, A. (eds.) (1996) *From Place to Place – Maps and Parish Maps*. Common Ground, London.

Participant observation	
Introduction	Participant observation is an ethnographic research method often associated with anthropology, sociology and human geography. It allows the researcher to have intimate and potentially lengthy spells of contact with a subject or group, to get detailed insights in real life situations. This may involve living or working with subject groups or attending organized gatherings such as community and cultural events, or meetings. An advantage of participant observation is that the gap between what people claim they do (for example in a survey) and what they really do is overcome; it can also develop trust and rapport. The technique requires a high degree of self-reflection on the part of the researcher, relying on his/her ability to collect sensory data. Consideration also needs to be given to the potential effect of a researcher's 'visibility' on subjects' behaviours; ensuring accurate record-keeping, especially if this is done after an event has taken place; and what subjectivities may affect perception and analysis of the practices being witnessed.
Purpose	Participant observation is a technique where being (to a greater or lesser extent) involved in real life situation can provide detailed, qualitative insights about different types of (social) practices carried out by individuals or groups.
Procedure	• Identify the situations you want to observe and approach the organisers to arrange participation. • Develop a protocol for capturing the data required from the observation. This could include the methods of data collection (voice recording, photography, etc.), the level and nature of active participation, data recording and analysis procedures, proposals for protecting confidentiality etc. (An alternative is to work 'undercover', which will have distinctive ethical considerations.) • Beforehand, determine the nature of data collection. For example, highly structured techniques might include preparing lists which can be checked against certain behaviours or actions, while less structured approaches will lack these. • Is it necessary to gain trust before the observation takes place? In which case, do key 'gatekeepers' need to be approached? • When carrying out the data collection, consider what additional recording methods may be available to supplement your own. These may include meeting minutes or newspaper/social media coverage of an event. Referring to these can be useful ways to glean other perspectives. If more than one researcher is present, the same techniques can be compared or different techniques can be complementary. • When using unstructured methods, ensure that data recording is completed as soon as possible after the event has taken place, to avoid memory loss of details. • Having validated/triangulated your data with other sources, it may even be desirable to get an insider (a fellow participant) to check your data for accuracy or different perspectives. • One important consideration is time – active participant observations which require the development of trust may take a considerable period of time to prepare, as might participation in strategic decision-making settings.
Resources	Participant observation is a widely-used research method in social science and a wealth of information and critical consideration is available, for example in qualitative research methods manuals.
Tips	It will be important to decide what level of participation a researcher will adopt. This can be relatively passive, for example attending and listening to a meeting but not contributing to the discussion. Or researchers might be more active contributors by joining discussions, or even fully active members of an innovation process. All of these are valid positions viz-a-viz research but will affect the situation being observed in different ways. It is important to try and make detailed notes as soon as possible after the end of the observed practice. A passive participant observer may be able to take notes or record discussions within a meeting, while an active participant will need to make time to record findings later.

	It may prove useful to have more than one participant observer to cross-reference observation notes and this may be especially the case for active participants, who may risk losing a sense of objectivity if they have a contributory function (e.g. as a member of a decision-making committee). Another way to triangulate data analysis is to ask the observation subjects to review the analysis.
Further information	A distinctive example of participant observation which has resonances with ROBUST is this account of a stag (men only pre-wedding) party of British men in Krakow:

Thurnell-Read, T. (2011) Off the leash and out of control: masculinities and embodiment in European stag tourism. *Sociology* https://doi.org/10.1177/0038038511416149 |

	Shadowing and placements
Introduction	Shadowing and placements are time-limited forms of accompanying and observing people in their routine situations. Shadowing is usually a 'one-on-one' observational method used in organisational and enterprise studies and its setting is commonly the workplace. However, projects or flows can also be shadowed. Placements are usually time-limited contributions to practice especially because they represent hands-on training opportunities.
Purpose	These formats of direct observation offer detailed and close insights into (usually, but not exclusively) routine practices in situ, as they are carried out. An obvious advantage of shadowing, for example, is that it should reveal what actually happens in people's lives, rather than what is expected of/planned for them. Another purpose of shadowing and placements is learning: both offer useful ways to pick up new knowledge by observing practice.
Procedure	Gill et al.'s excellent 2014 article gives clear reflections on shadowing experience and ten recommendations which are synthesized here in three broad headings: • Prepare – this includes thinking about the type of engagement with shadowees, how to keep records and what equipment is required, what to wear, engage with shadowees beforehand, how long the shadowing/placement will last etc. What paperwork may be needed (insurance, security, health and safety training, ethical approval etc.) may be needed before work starts? • Encourage reflection – to what degree is the action being observed context-dependent or representative of other periods? Is enough attention being given to interpreting and not just recording field experiences? Are new questions emerging from observations? What effect is being shadowed having on the shadowee? Are researchers working alone or in teams and if the latter, they should compare experiences. Time-stamping observations will help • Remain open – plans may need to change if observers find that their preparations do not, afterall, reveal details they had hoped for. This may require more interaction with the shadowee than planned, or some follow-up research linked to what has been seen. Some experimentation with recording techniques may be needed as work proceeds. Depending on the technique, shadowing and placements require careful thought about relationships. For example, how can a shadower avoid being a burden to the shadowee? Is there an implicit or even explicit hierarchical arrangement involved in a placement and how flexible can a placement be if it is linked to particular tasks or training?
Resources	Various software/on-line packages are available to help record and analyse shadowing data. These include Nvivo, the web-app Deedose, Skitch (digital note taking and web clipping), Adobe Ideas (a sketching app) and CamScanner (a smart phone scanner app).
Tips	Shadowing in the workplace will need careful thought about how to interpret what is happening, especially if routines rely on specialist ICT operation, uniform work practices, or where there is a blurring of workplace boundaries and times (for example if people work from home). Note-taking, video and audio recording may all be useful techniques for recording observations. Observers and observed alike may find it draining to communicate with one another for extended periods of communication. These techniques may demand some level of intrusion and those being shadowed may perceive they are being judged or evaluated, although this is not the intention of the technique. Researchers will need to be open and flexible, because day-to-day situations are not always predictable.
Further information	A special issue on shadowing as a research technique in organisational studies will prove invaluable. The two articles listed below from the special issue include the introduction (with a wealth of useful references) and a paper making clear recommendations based on research experiences:

McDonald, S. and Simpson, B. (2014) Shadowing research in organisatons: the methodological debates. *Qualitative Research in Organizations and Management: An International Journal* 9(1):3-20.

Gill, R., Barbour, J. and Dean, M. (2014) Shadowing in/as work: ten recommendations for shadowing

fieldwork practice. *Qualitative Research in Organizations and Management: An International Journal* 9(1):69-89.

The following article may prove useful when considering shadowing out-of-doors: Jones, P., Bunce, G., Evans, J., Gibbs, H. and Ricketts Hein, J. (2008) Exploring space and place with walking interviews. *Journal of Research Practice* 4(2): D2.

Participatory Scenario building	
Introduction	Scenarios are representations of the future, which allow the present to be examined in the light of possible future outcomes. Participatory scenario building (PSB) is increasingly used in forecasting and strategy development. Scenarios may be normatively framed (i.e. as alternatives to the present) or exploratory (as the likely outcome of certain patterns or actions).
Purpose	Participatory scenario building is a way to discuss complex problems by groups of stakeholders, and to devise and agreement actions to address them in a transparent manner. As well as strategy development, PSB is useful in sustainable and community development approaches.
Procedure	There are several methods for scenario building, which are described and evaluated by Amer et al. (2013, see below). Procedures will depend on the format adopted by are likely to include: • Definition of the problem/issue which a future scenario is to address and the time period of the analysis (i.e. will the scenario envisage the position in 5, 10 or 20 years etc.) • Recruitment of group of participants, which should, initially, be as large as possible to be able to ensure that participants can contribute knowledge and insights about trends, patterns and desirable future developments. • Identify key events, drivers and influences on the current scenario. • Articulate key indicators of progress towards future change. • Develop a set of probabilities and assess these. This task may need to be divided into groups of stakeholders which report back to a plenary group; or be taken on by a smaller co-ordinating group of participants. • Consider influencing events and how these may be encouraged/mitigated. • Having developed an agreed future scenario, conclude with a series of strategic decisions, complemented by narratives.
Resources	This tool aims to support PSP for climate adaptation: https://www.weadapt.org/knowledge-base/adaptation-decision-making/atk-participatory-scenario-building
Tips	Successful PSB, according to Durance and Godet (2010, see below), must be characterized by five attributes: patience, coherence, likelihood, importance and transparency. It is important to consider that the process of PSB is likely to take time and have different stages, which may not involve the same actors. These authors also suggest that questions which lack general consensus can be the most desirable to discuss, because these are most likely to changed established orders and ways of thinking. This is especially important when visualizing alternative future scenarios. One danger is that the effort of PSB outweighs its utility in practice.
Further information	Durrance, P and Godot, M. (2010) Scenario building: uses and abuses. *Technological Forecasting & Social Change* 77:1488-1492. Amer, M., Daim, T.U. and Jetter, A. (2013) A review of scenario planning. *Futures* 46:23-40. McBride, M.F., Lambert, K.F., Huff, E.S., Theoharides, K.A., Field, P and Thompson, P. (2017) Increasing the effectiveness of participatory scenario development through codesign. *Ecology and Society* 22(3):16 https://www.ecologyandsociety.org/vol22/iss3/art16/ See also: https://naturalsciences.ch/topics/co-producing_knowledge/methods/scenario_integration

Role playing	
Introduction	Many social and environmental challenges require not just technical transformations, but different approaches to social and institutional interaction. Role playing (and role playing games) is a low-risk method for stakeholders to envisage, explore and discuss alternative or future scenarios to the status quo. Role playing thus allows people to participate in scenario simulations that might not normally be acceptable to their employers/constituencies.
Purpose	Role playing is a form of multi-stakeholder learning. It allows participants to examine scenarios and processes for problem solving by acting out defined roles of stakeholders whose interests are affected by, or dependent on, proposals to create change. Role playing can be particularly effective when issues are contested, when multiple approaches to solutions seem possible, or when it is desirable to reveal interdependencies between parties. Role playing is also an effective skills development tool where simulations or hypothetical scenarios are played out.
Procedure	As with many participatory methods, stakeholders may need to come together physically in a workshop. However, if role playing games are used, these may be available as software programmes, or as (analogue) board games.
	Each role-playing scenario requires a compelling narrative which frames the discussion. Salvini et al (2016) (see below) developed a narrative around the benefits of adopting agro-forestry practices among farmers. Such narratives set the scene and the focus of the role playing. (This narrative is important in the light of Innes & Booher's assertion that 'many participants in consensus building arrive without a clear idea of what their interests are in relation to the task…' (1999:14).
	Role playing may then proceed by considering the consequences of a scenario, for example development of land, particular types of investment/withdrawal of investment, changes in labour supply or market prices. Participants will need to be clear about the roles they are expected to play, for example, they might represent their own interests in relation to changing scenarios, or act in the role of other stakeholders in the scenario, thus trying to represent alternative perspectives to their own.
	If consensus required from the process, role playing should be devised as collaborative, in order that participants reach joint goals through mutual support.
	Individual or group Interviews may be beneficial before and/or after the role-playing experience, to evaluate how/if stakeholders' perceptions or knowledge changed, or to examine reactions to any suggested outcomes in a more candid way. This is useful because role playing is not just the enactment of a simulation, but a way for participants to learn to creatively react to unexpected scenarios.
	The web-site 'mind tools' (see resources) offers a succinct procedure for role playing for 2 or more people as a form of preparation for important meetings or scenario building, and suggests the following general steps:
	• Identify the situation • Add details • Assign roles • Act out the scenario • Discuss what you have learnt
Resources	https://www.mindtools.com/CommSkll/RolePlaying.htm
Tips	Role-playing will require a clear format and a moderator/facilitator.
Further information	Salvini et al. devised a role-playing game to examine opportunities for adopting agro-forestry as a contribution to climate smart agriculture in Brazil.

Salvinia, G., van Paassen, A., Ligtenberga, A., Carreroc, G.C., Bregta, A.K. (2016) A role-playing game as a tool to facilitate social learning and collective action towards Climate Smart Agriculture: Lessons learned from Apuí, Brazil. *Environmental Science & Policy* 63, 113-121. https://ac-els-cdn-com.glos.idm.oclc.org/S1462901116302167/1-s2.0-S1462901116302167-main.pdf?_tid=d922f021-3b2c-41ae-b2fd-33e8ce5ffedb&acdnat=1540291653_3f54c6e51b0ee9801196184efde2faac

The use of role playing in spatial planning scenarios is covered in Innes, J & Booher, D. (1999) Consensus Building as Role Playing and Bricoloage: Towards a Theory of Collaborative Planning. *Journal of the American Planning Association* 65(1): 9-26. http://web.a.ebscohost.com.glos.idm.oclc.org/ehost/pdfviewer/pdfviewer?vid=1&sid=3dce84f2-acba-41fd-92c4-303776e37f7d%40sdc-v-sessmgr02

Evaluation questionnaires	
Introduction	Evaluation questionnaires, as the name suggests, pose questions which enable participants to reflect on their experiences of having taken part in a research process, meeting, consultation or event etc. Generally, questions will be structured or partially semi-structured, depending on when the questionnaire is to be completed – immediately after an event, or after a period of reflection. Questionnaires may be used periodically, for example as a means of comparing experiences before and after a process of engagement.
Purpose	Evaluation questionnaires help to articulate and assess the experiences of participants' engaged in a process of change. The collected data is intended to help inform improvements in the further development of the process.
Procedure	Typically, procedures for developing evaluation questionnaires may include: • Deciding on the nature of the evaluation – e.g. is the questionnaire going to evaluate personal perceptions of involvement in a process, knowledge that was gleaned, clarity of the outcomes of the process etc. • Whose views are going to be evaluated through the questionnaire? Direct participants in an event, or indirect beneficiaries? • Development of a questionnaire. • Agreement of the form of analysis and unit of analysis, e.g. quantitative (e.g. the percentage of participants who felt the process was useful/enjoyable., use of Likert scales etc.), or qualitative (e.g. the nature, range and detail of responses to being part of the process using free composition). • Devising a method of questionnaire completion (paper forms, on-line, verbal answers provided to evaluators etc.). • Devising a strategy to ensure questionnaires are completed and that data is applied to the inform the analysis conclusions.
Resources	Support in developing evaluation questionnaires, including a template for a simple post-event evaluation form is available here: https://evaluationtoolbox.net.au/index.php?option=com_content&view=article&id=58&Itemid=154 More complex evaluative survey support for sustainable development interventions is offered by the OECD.
Tips	Wording of the questionnaires is crucial, and this depends on (one or more) clear evaluation objectives.
Further information	

Webinar/on-line forum	
Introduction	Webinars are on-line seminars (web-seminars), lectures or fora, allowing information to be relayed, or group discussions to take place on-line. Some webinar packages contain functions such as graphic displays, data manipulation and document editing, making such webinars useful for process development without the expense associated with travelling to meetings. Webinars can be recorded, edited and posted on-line (for example through a synch to Youtube), making them a useful and popular format of blog communication. One clear advantage of webinars is that they are accessible from more or less anywhere, including via mobile devices.
Purpose	Webinars allow interactive on-line group discussions, training and instruction, or consultations to take place, which can then be captured as a knowledge resource.
Procedure	Procedures depend on the software choice.
Resources	A variety of different webinar platforms are available, some which require a license subscription, such as Adobe Connect, while others such as Google Hangouts are free.
Tips	Streaming a live webinar takes up a lot of bandwidth, so high-speed broadband connections are required. A moderator will be needed to chair the flow of discussion and manage multiple contributions.
Further information	The following website shows a webinar on natural capital in the New Forest National Park in the UK, developed by the NGO Ecosystems Knowledge Network: https://ecosystemsknowledge.net/events/webinars/library

Systematic Evidence Review	
Introduction	Systematic evidence reviews (SER) provide, most simply, methodical reviews of evidence within a rationalized and transparent structure. Literature reviews are a form of SER, as are the 'state of play' rapid appraisals carried out in WP2 of Robust. Other forms of SER may include summaries or newspaper articles, longitudinal studies or histories of policy developments. SER is often associated with secondary and 'desk' research, although primary forms of SER might include social media analysis.
Purpose	Systematic evidence reviews can be used to summarise, synthesise or evaluate other studies or forms of qualitative and quantitative evidence. Such reviews support the development of future research agendas and guide policy development or provide up to date reflections on developments in particular research fields.
Procedure	Decide on the objective of the SER by considering: • Scope – will it be exhaustive or selective? Is the purpose to identify gaps in knowledge, emphasise less prominent perspectives, review the relationship between research and practice? • Structure – thematic, historic, how issues have been framed, policy reviews etc. • Sources – these may include articles, technical reports, policies, films, blogs etc. • Team – if the SER is to reflect upon practice, it will be vital to include a practitioner within, or at the head of, the research team • Next steps – how does the SER inform e.g. research questions, policy analysis, contradictions, cause and effect, insights into required actions/interventions, the identification of key people/networks. Ensure that the SER is not simply a list of knowledge. It should be an argued insight, supported by the evidence reviewed, deduced by following the stated structure of the review.
Resources	Forms of systematic review techniques are covered in a wide range of social science research manuals.
Tips	The rigour of the systematic approach will lie in the alignment between review objectives, data review methods and conclusions. Researcher bias (a form of qualitative data variable) will need to be considered when developing the review approach.
Further information	The articles in the journal Progress in Human Geography often take the form of reviews. A manual linked to SER in social work, which specifically illuminates the links or gaps between research and practice is: Bronson, B. and Davis, T (2011) *Finding and evaluating evidence: systematic reviews and evidence-based practice*. Dawson Books, Swindon.

Storywall	
Introduction	The storywall method allows different actors to retrospectively (ie. after a process has taken place) look at how they have perceived a joint process, e.g. a process of co-producing knowledge. It uses storytelling to collect the individual perspectives and to create a joint understanding of the past. It acknowledges and makes use of the possibility that different participants in a process have different perspectives on how things have happened.
Purpose	**Storywall is a graphic, story-based, qualitative method for retrospectively assembling crucial events in a collective process.**
Procedure	• As a starting point, a simple timeline indicating the start and the end dates of the joint process or story is provided. • The group members collectively discuss whether to further structure the paper's timeline, for example, into project parts, organizational levels, or main process phases. • The actors individually identify key events or dominant influences. They may also want to identify those that have either supported or hindered the process, as well as other relevant story elements with respect to reflection and exchange. • Based on the individual elements, the actors jointly create a storywall picture of their process, representing their group's collective understanding of it. This is the main step because different perceptions and experiences are shared, and the process elements are discussed. • In case the storywalls are made in subgroups, they can subsequently be presented to the full group. • In addition to the reported stories with their elements, the main lessons learned can be selected and used to create an ideal storywall. The outcome of a storywall exercise is a poster of the story featuring its most important elements out of the perspective of the group and its members.
Resources	
Tips	
Further information	Information listed for this technique has been drawn from the Swiss natural sciences website, which also provides illustrations of a completed storywall: https://naturalsciences.ch/topics/co-producing_knowledge/methods/storywall

Social Network Analysis	
Introduction	Social network analysis involves the mapping and measuring of relationships and flows between people, groups, organisations, computers or other information/knowledge processing entities." (Valdis Krebs, 2002). Social Network Analysis (SNA) is a method for visualizing people and connections, enabling a better understanding of how best to interact and share knowledge. There are also methods to actually measure network interaction, power etc. (e.g. UCINET).
Purpose	Improve knowledge sharing, build communities and understand the structures of existing networks/communities: • Information flow / interaction • Identify powerful positions in the network: information brokers, bottlenecks, information sources • Identify subgroups • Visualize relationships. • Facilitate identification of who knows who and who might know what - teams and individuals playing central roles - thought leaders, key knowledge brokers, experts, etc. • Identify isolated teams or individuals and knowledge bottlenecks. • Strategically work to improve knowledge flows. • Accelerate the flow of knowledge and information across functional and organisational boundaries. • Improve the effectiveness of formal and informal communication channels • Raise awareness of the importance of informal networks
Procedure	Key stages of the process will typically include: • Identifying the network of people to be analysed (e.g. team, workgroup, and department). • Gathering background information - interviewing managers and key staff to understand the specific needs and problems. • Clarifying objectives, defining the scope of the analysis and agreeing on the level of reporting required. • Formulating hypotheses and questions. • Developing the survey methodology and designing the questionnaire. • Surveying the individuals in the network to identify the relationships and knowledge flows between them. • Use a software mapping tool to visually map out the network. • Reviewing the map and the problems and opportunities highlighted using interviews and/or workshops. • Designing and implementing actions to bring about desired changes. • Mapping the network again after a suitable period of time.
Resources	Ucinet / Netdraw, Visone (good for visualisation)
Tips	To do a full network analysis, it is crucial to: 1. Clearly define the boundaries of your network. 2. To thoroughly think of the question to ask EACH of the members of the network. For Ego-Networks you do not have to interview all members of a network, but the focus is more on the individual (as embedded in a network)
Further information	http://www.kstoolkit.org/Social+Network+Analysis http://www.visone.info/

Joint visioning	
Introduction	Visioning is a collective exercise carried out within a group of people to establish a joint vision of the future direction to be taken. Visioning is an unconstrained variation of scenario planning in which a desirable future is defined. With maximum participation, many different perspectives are shared to create a joint vision of the future that may help to achieve the desired future. This approach is centred around maximum participation, with the logic that those involved in defining an organisation's future path will be most committed to following that path. The outcome of a joint visioning exercise is a medium-to-long-term plan that provides the framework for a strategy to achieve the collective vision.
Purpose	Visioning tools may also be used to promote thought and encourage discussion of future resource use and planning options, without the need to create a future-orientated document. Visioning can be used for integrated approaches (e.g. in policy-making) due to its cooperative character, which allows for multi-agency involvement, frequently including joint inter-agency leadership. It is often used to facilitate the widest possible participation for developing long-range plans/strategies or to formulate certain directions. It can be applied to: • to set the stage for short-range planning activities; to set new directions (e.g. in policy); to review existing measures, policies, etc.; when integration between issues is required; when a wide variety of ideas should be heard; or when a range of potential solutions is needed.
Procedure	In a typical visioning exercise, a facilitator asks participants to close their eyes and imagine something as they would like to see it in some years. There is considerable flexibility in selecting the precise procedure in a joint visioning exercise. Participants can record their visions in written or pictorial form: in diagrams, sketches, models, photographic montages and written briefs. Sometimes, a professional illustrator or artist may help to turn mental images into drawings. Five stages in building a vision have been identified by Bezold (1997): 1) identification of problems, 2) identification of past successes 3) identification of future desires; 4) identification of measurable goals; and 5) identification of resources to achieve those goals. Finally, the visions are presented, and the group discusses and comments on these visions; this may also include discussions about what was easy and what was difficult about the process, and what they learned.
Resources	Few physical resources are needed in joint visioning exercises although it requires willingness, trust and imagination from participants.
Tips	In the absence of pre-established ground rules, some participants can feel that the process favours the stronger and more vocal participants. This can be countered by effective moderation of the workshops, such as effectively enforcing previously agreed ground rules.
Further information	**Examples** Ames, Steven C. (1989) Charting a Course for Corviallis: A Case Study of Community Visioning in Oregon, Gresham, Oregon: American Planning. Association (Oregon Chapter), Oregon Visions Project. PSI-Connect project: Joint visioning in Arnemuiden http://public.cranfield.ac.uk/c082621/psi%20connect/documents/d1.3_psiconnect_report_ on_prototypes_of_kb_instruments.pdf (p.34) **Further Information:** Bezold, C. 1997, The Visioning Method, in Slaughter, R. (ed) The Knowledge Base of Futures Studies: Vol 2, Organisations, Practices, Products. Vicotoria, Australia: DDM Media Group New Economics Foundation and UK Participation Network (1998) 'Participation Works: 21 Techniques of community participation for the 21st century' http://www.neweconomics.org/gen/uploads/doc_1910200062310_PWA4.doc

The World Futures Society, Methods and Approaches of Futures Studies, *http://crab.rutgers.edu/~goertzel/futuristmethods.htm*

Ames, Steven C. (1993) The Agency Visioning Handbook: Developing A Vision for the Future of Public Agencies, A Hands-on Guide for Planners and Facilitators in State and Federal Natural Resource Agencies. Arlington, Virginia: US Fish and Wildlife Service

Magnuszewski, P., Sodomkova, K., Slob, A., Muro, M., Sendzimir, J., Pahl-Wostl, C. (2010) Report on conceptual framework for science-policy barriers and bridges. Project report from PSI-connect – Policy Science Interactions: connecting science and policy.

Foresight analysis– scenario analysis	
Introduction	Scenario analysis is a workshop-based process that is similar to joint visioning in that the purpose is to identify future directions; however, it takes a slightly different approach. Instead of starting with a blank canvas when envisioning possible futures, scenario analysis involves the analysis of possible alternatives of the future (scenarios) to present a range of several (typically three) alternative future *outcomes* (Huss, 1988). Scenario analysis inherently involves a degree of systems thinking since it requires consideration of many influencing factors that may interact in complex ways (due to non-linear feedback loops) to create the range of possible likely futures. The exercise of considering future scenarios forces some consideration of the current state of the network, the desired future direction, and the factors which enable or hinder the desired future positioning (Aaker, 2001).
Purpose	Participatory scenario building processes enhance consensus building and increase the level of social learning by creating a common language and understanding. The method stimulates critical thinking, challenges prevailing assumptions and contributes to building future-oriented knowledge and innovation networks.
Procedure	A possible procedure is as follows: • Assess the factors that may affect the development of the network. • Describe desired future outcomes and the steps that will influence these visions. • Measure the actual situation and development of possible projections (possibilities for development without giving a probability of occurrence). • Assess trends with a quantifiable probability of occurrence. • Relate trends and projections to each other and identify possible links. • Develop a strategy to maximise benefits and minimise risks (Huss, 1988).
Resources	Few resources are required for scenario analysis.
Tips	The method views the network as a specific entity, which is capable of having a unified strategy and direction. This may not be the case, particularly in informal networks.
Further information	**Further Information:** Aaker, D. (2001). *Strategic Market Management*. New York: John Wiley & Sons. pp. 108 et seq.. ISBN 0-471-41572-3. Bukisa, An Introduction to the Scenario Analysis Method: http://www.bukisa.com/articles/442838_an-introduction-to-the-scenario-analysis-method#ixzz1PpQAjwYt Huss, W. 1988, A move toward scenario analysis, International Journal of Forecasting, 4 (3): 377- 388. Swart, R., Raskin, P. and Robinson J. (2004) The problem of the future: sustainability science and scenario analysis Global Environmental Change, 14: 137–146

Scenario building	

Introduction	There are various definitions of scenarios and scenario development, but there is general agreement that scenarios are *not* predictions or projections (van Notten et al., 2003); rather they are narrative descriptions of potential futures with the assumption that future developments are unpredictable. In general, it is possible to distinguish between three different modes of thinking about the future by asking *What will happen? What can happen? How can a specific target be reached?*:
	
	1) **predictive scenarios**: these consist of two different types:
	   a) *what-if scenarios*
	   b) *forecast scenarios*
	2) **exploratory scenarios:** aim to explore possible futures and develop a set of scenarios on a long-time horizon in order to allow for structural changes. They can be divided into:
	   a) *external scenarios,* which focus on factors that cannot be controlled by the actors
	   b) *strategic scenarios,* which aim to describe possible outcomes of strategic decisions.
	3) **normative scenarios**: aim to reveal how certain future situations or objectives can be reached. One may distinguish between two types of such scenarios:
	   a) *preserving scenarios* assume that the targets can be reached without transformation
	
	   b) *transforming scenarios* are used if structural changes are needed
	
	In practice, scenario building can also be built on combinations of the above.

Purpose	Scenarios are particularly useful where the past or present is unlikely to be a guide to the future. The main applications are to: • respond to and influence development • generate alternative trajectories for future developments • to consider multiple variables simultaneously • discover existing problems and identify uncertainties • enhance consensus building and increase the level of social learning • create a common language and understanding – working across disciplines, departments etc. • stimulate critical thinking and challenge prevailing assumptions • improve long-term decision-making • build future oriented knowledge and action networks • examine policies/strategies with regard to their robustness across a range of possible futures
Procedure	Several scenario building methods have been developed; the implementation procedure cited here is a common approach, developed by Schwartz (1996): **Step 1**: Identification of the **focal issue or decision**, as well as the scope (e.g. region) and time horizon (e.g. 10 years). **Step 2**: Identification of the **key forces/factors in the local environment** (micro-environment) that might influence the outcome (e.g. consumption patterns, supply, transport, etc.). **Step 3**: **List of driving forces and barriers** (macro environment). (e.g. social, environmental, economic, technological, political, demographics and public opinion) that will or could affect the key factors. This is the most work-intensive step; it can be done in a scenario workshop, but also through interviews, focus groups, additional research, etc. **Step 4**: **Ranking** of key forces and drivers by importance and uncertainty. For each of the forces and drivers the degree of importance for the success of the focal issue/decision needs to be identified, as well as the degree of uncertainty as to how it will develop. This rating can be done within a scenario workshop or separately by doing interviews or focus groups. **Step 5**: Selection of **scenario logics.** Two or three key factors (identified within step 2) need to be chosen to provide the 'logics' (assumptions) of the scenarios. They build the 'axes' along which eventual scenarios will differ (e.g. a globalisation axis differing between local/regional and global, and a social values axis differing between community and individual would result in four scenarios: community/global, individual/global, individual/regional, and community regional).

	Step 6: **Fleshing out the scenarios**. The logics give the skeleton of the scenarios. In this step, the scenarios need to be fleshed out by returning to the key factors and trends listed in Steps 2 and 3. **Step 7: Exploration of Implications**. This step refers back to the focal issue or decision in Step 1 and explores how a strategy can be adapted to make it more robust; the implications for the focal issue or decision need to be considered for each scenario. Is the strategy robust across all scenarios? **Step 8**: **Selection of leading indicators and signposts**. The purpose is to be able to detect various actual developments as early as possible so that the strategies can be adapted appropriately. A review of all the scenarios will provide information on leading indicators and signposts for each scenario. The more concrete these indicators are, the easier it is to monitor them and to detect the emergence of (future) developments. **Step 9**: **Development of a strategy**. Scenarios could also be used for strategic planning, to move from scenarios to plans and to inform decision making. Ringland (2002) describes this step as including several activities: strategic analysis (e.g. by using SWOT), scenario creation, strategy finding (strategic orientation), and finally the formulation of a strategy.
Resources	
Tips	According to Schwarz (1996)1 the following aspects need to be considered when developing scenarios: • Beware of ending up with three scenarios. People are tempted to identify one of them as the "middle" or "most likely." But also avoid having too many scenarios. • Avoid assigning probabilities to scenarios. However, it may make sense to make two reasonably likely scenarios and compare them to two "wild card" scenarios. • Pay attention to the naming your scenarios. Successful names telegraph the scenario logics. • You can tell you have good scenarios when they are both plausible and surprising; when they have the power to break old stereotypes; and when the makers assume ownership of them and put them to work. Scenario making is intensely participatory, or it fails.
Further information	*Examples* Agrimonde Scenarios and Challenges for Feeding the World in 2050 http://www.fcrn.org.uk/sites/default/files/Agrimonde_Feeding_the_world_in_2050_Summary_Report.pdf Catham House Food Supply Project. https://www.hsdl.org/hslog/?q=node/4165 CONSENTSUS Project. http://consentsus-project.pbworks.com/w/page/16379760/FrontPage Gotheborg 2050. http://www.goteborg2050.se WWF Livewell study. http://assets.wwf.org.uk/downloads/livewell_report_corrected.pdf Getting into the right land for EU 2050. http://www.rivm.nl/bibliotheek/rapporten/500150001.pdf FAAN Project. http://www.faanweb.eu/sites/faanweb.eu/files/FAAN_D4_Scenario_Workshops.pdf Lienert, J., Monstadt, J. and Truffer, B. (2006) Future scenarios for a sustainable water sector: A case study from Switzerland. Environmental Science and Technology 40 (20), 436-442 *Further information* Danish Board of Technology: www.tekno.dk Cairns, G., Wright, G., Van der Heijden, K., Bradfield, R. and Burt, G. (2006) Enhancing foresight between multiple agencies: Issues in the use of scenario thinking to overcome fragmentation. Futures 38(8), 1010-1025. Ringland, G. (2002) Scenarios in Public Policy. West Sussex: John Wiley & Sons Ltd. Schwartz, P. (1991) The Art of the Long View. Chichester: John Wiley & Sons. OKeefe M. and Wright G. (2010) Non-receptive organizational contexts and scenario planning interventions: A demonstration of inertia in the strategic decision-making of a CEO, despite strong pressure for a change. Futures, 42(1), 26- 41. Participatory methods toolkit: A practitioner's manual (2005); joint publication of King Baudouin Foundation and the Flemish Institute for Science and Technology

Assessment (viWTA), http://www.viwta.be/files/30890_ToolkitENGdef.pdf Van der Heijden, Kees (1997) Scenarios: The Art of Strategic Conversation. Chichester: John Wiley & Sons.

Van der Heijden, Kees (2000) Scenarios and forecasting: Two perspectives. Technological Forecasting and Social Change 65(1), pp.31-36.

Van der Heijden, K., Bradfield, R., Burt, G., Cairns, G. & Wright, G., (2002) The sixth sense: Accelerating organisational learning with scenarios

Van Notten, P.W.F., (2005) Chapter 4. Scenario Development: a typology of approaches. Chapter based on doctoral dissertation – Writing on the wall. Scenario Development in Times of Discontinuity. http://www.oecd.org/dataoecd/27/38/37246431.pdf

Van Notten, P.W.F., Rotmans, J., van Asselt M.B.A. & Rothman D.S., (2003) An updated scenario typology. Futures 35(5), pp. 423-443.

Volkery, A. and Ribeiro, T. (2009) Scenario planning in public policy: Understanding use, impacts and the role of institutional context factors. Technological Forecasting and Social Change 76(9), 1198-1207.

Wehmeyer, Walter, Clayton, Anthony and Lum, Ken (eds.) (2002) Greener Management International, Issue 37: Foresighting for Development.

Concept Mapping	
Introduction	Concept mapping is a structured process, focused on a topic or construct of interest, involving input from one or more participants, that produces an interpretable pictorial view, a concept map, of their ideas and concepts and how these are interrelated. While mind mapping aims to collect ideas, concept mapping aims to synthesize ideas.
Purpose	Concept mapping is a graphical tool for exploring and organizing knowledge and for gathering and sharing information. It helps people to think more effectively as a group without losing their individuality. It can be used for: • Summarizing key concepts, their relationships and hierarchy from documents and source materials • Collaborative knowledge modelling and the transfer of expert knowledge • Facilitating the creation of shared vision and shared understanding within a team • Providing an initial conceptual frame for subsequent information and learning • Communicating complex ideas and arguments • Examining the symmetry of complex ideas and arguments and associated terminology • Detailing the entire structure of an idea, train of thought, or line of argument (with the specific goal of exposing faults, errors, or gaps in one's own reasoning) for the scrutiny of others
Procedure	Concept mapping involves six steps that can take place in a single day or can be spread out over weeks or months: 1. **Preparation Step:** First, the facilitator of the mapping process works with the initiator(s) to identify who the participants will be. Second, the facilitator must then work with the participants or a subgroup to decide on the specific focus for the conceptualization. Finally, the group decides on an appropriate schedule for the mapping. 2. **Generation Step**: Once the participants and focus statements have been defined, the actual concept mapping process begins with the generation of a set of statements which ideally should represent the entire conceptual domain for the topic of interest. In a typical case, brainstorming is used and the focus statement constitutes the prompt for the brainstorming session. 3. **Structuring Step**: Once a set of statements, which describes the conceptual domain for a given focus, has been compiled, information needs to be provided about how the statements are related to each other. In addition, we often want to rate each statement on some dimension which is defined by the rating focus statement. Both of these tasks constitute the structuring of the conceptual domain. 4. **Representation Step** is where the analysis is done. This is the process of taking the sort and rating input and "representing" it in map form. There are two major statistical analyses that are used. The first (multidimensional scaling) takes the sort data across all participants and develops the basic map where each statement is a point on the map and statements that were piled together by more people are closer to each other on the map. The second analysis (cluster analysis) takes the output of the multidimensional scaling (the point map) and partitions the map into groups of statements or ideas, into clusters. If the statements describe activities of a programme, the clusters show how these can be grouped into logical groups of activities. If the statements are specific outcomes, the clusters might be viewed as outcome constructs or concepts. 5. **Interpretation Step:** 1. we conduct an analysis which locates each statement as a separate point on a map (i.e., the point map). Statements which are closer to each other on this map were likely to have been sorted together more frequently; more distant statements on the map were in general sorted together less frequently. 2. We group or partition the statements on this map into clusters (i.e., the cluster map) which represent higher order conceptual groupings of the original set of statements. 3. We can construct maps which overlay the averaged ratings either by point (i.e., the point rating map) or by cluster (i.e., the cluster rating map). 6. **Utilization Step:** The group discusses how the final concept map might be used to enhance either the planning or evaluation effort. The uses of the map are limited only by the creativity and motivation of the group.
Further information	*Examples* Concept mapping fuels: http://www.energyeducation.tx.gov/pdf/223_inv.pdf Diet, Food and Health Concept Map. https://lh5.googleusercontent.com/-zlbbFAt2KsI/TX7oJSwx9ZI/AAAAAAAADCI/AzFZY-QFaPo/s1600/health_diet_food_concept_map2.jpg

	Further information Moon, B.M., Hoffman, R.R., Novak, J.D., & Cańas, A.J. (2011). Applied Concept Mapping: Capturing, Analyzing and Organizing Knowledge. CRC Press: New York. Novak, J. D. & A. J. Cañas, (2008), The Theory Underlying Concept Maps and How to Construct and Use Them, Technical Report IHMC CmapTools 2006-01 Rev 01-2008, Florida Institute for Human and Machine Cognition, available at: http://cmap.ihmc.us/Publications/ResearchPapers/TheoryUnderlyingConceptMaps.pdf Trochim, W. (1989). An introduction to concept mapping for planning and evaluation. In W. Trochim (Ed.) A Special Issue of Evaluation and Program Planning, 12, 1-16. http://www.socialresearchmethods.net/research/epp1/epp1.htm Trochim, W. (1993) Reliability of Concept Mapping. Paper presented at the Annual Conference of the American Evaluation Association, Dallas, Texas. http://www.socialresearchmethods.net/research/Reliable/reliable.htm Wilson, B. (1980), Systems: Concepts, methodologies and Applications, John Wiley & Sons. The knowledge sharing toolkit online resource: http://en.wikiversity.org/wiki/Concept_mapping

Mind Mapping	
Introduction	A mind map is a graphical way to represent ideas and concepts. It is a visual thinking tool, which consists of a central word or concept (preferably a picture), around which ideas that relate to that image are drawn. As a non-linear method of organizing information, it allows the capture of the natural flow of ideas and can help obtain a shared perspective on a complex project. Mind maps can be hand-drawn on flip charts or rendered with computer software (Novak & Canas, 2008). Depending on the task, the method is suitable for reflection on process and outcomes and can both support and allow monitoring of learning in a network. Similarly, the method can be used to assess change and to reflect on the development and function of a network. Essentially mind mapping aims to collect ideas, while concept mapping aims to synthesize ideas.
Purpose	Mind maps are used for: • note taking • structuring information • brainstorming (individually or in groups) • motivate creativity • better analyse, comprehend, synthesize, recall and generate new ideas • problem solving • studying and memorization • (strategic) planning • exploring and consolidating information from multiple sources • presenting information • gaining insight on complex subjects Contrary to traditional note taking or linear text, in a mind map the information is structured in a way that resembles much more closely how your brain actually works. Since it is an activity that is both analytical and artistic, it engages your brain's cognitive functions and avoids linear thinking.
Procedure	Mind mapping can be done by simply using paper and utensils for physical drawing, but it also can be implemented with software tools (see e.g. http://www.graphic.org). The general procedure is very simple: 1. Start by writing or drawing the main idea in the middle of a blank page. 2. Develop the related subtopics around this central topic, connecting each of them to the centre with a line. One may work outward in all directions, producing a growing and organized structure composed of key words and images 3. Repeat the same process for the subtopics, generating lower-level subtopics as they fit, connecting each of those to the corresponding subtopic.
Resources	http://www.mindmeister.com/
Tips	Recommendations for drawing the map: • Using colours, drawings and symbols. Pictures can enable information to be remembered more effectively than words. • Varying text size, colour and alignment: A variation in the thickness and length of the lines can be used to emphasize important points. Colours may help to separate ideas/subtopics. • Keeping the topic labels as short as possible, keeping them to a single word – or, better yet, to only a picture. The mind map will be much more effective this way. • Drawing lines to highlight cross-linkages: showing how information in one part of the Mind Map may relate to another part. This helps to see how one part of the subject affects another. The elements of a given mind map are arranged intuitively according to the importance of the concepts, and are classified into groupings, branches, or areas, with the goal of representing semantic or other connections between information. Mind mapping may be conceptually difficult for some people. It requires some drawing ability and the establishment of common protocols.

Further information	Decision Explorer webpage: http://www.banxia.com/dexplore/resources/whats-in- a-name/ http://omni.bus.ed.ac.uk/opsman/oakland/inst18.htm Buzan, T. 2000, The Mind Map Book, Penguin Books. Buzan, Tony (2006) The Mind Map Book", BBC Active. Wikipedia: http://en.wikipedia.org/wiki/Mind_map Beel, J., Gipp, B. and Stiller, J. (2009). "Information Retrieval On Mind Maps - What Could It Be Good For?" Proceedings of the 5th International Conference on Collaborative Computing: Networking, Applications and Worksharing (CollaborateCom'09). Washington: http://www.sciplore.org/publications_en.php

Systems Mapping	
Introduction	Systems maps are used as thinking tools; they can also be used as communication tools. They have a simple form, consisting of blobs and words, and they are used to show the structure of a system of interest at a point in time. They show this structure as a hierarchy of groupings.
Purpose	As a thinking tool it can be used to reflect, understand and plan. As a communication tool it can be used to show, describe and guide. System maps can be used to: • model an existing, explicit structure. • create a new mental model, which then facilitates structuring thinking about systems and to discuss this with others.
Procedure	A system map can be done from the bottom up or top down. *Top down*: is useful when a clear purpose for the system of interest has been identified. 1) Drawing the boundaries of the system. 2) Draw the subsystems, then the sub-sub-systems, and so on (always moving down a level). **Bottom up**: is useful where the purpose for the system of interest is still undecided, but where many of the elements of the system can be identified. 3) Draw the elements/components likely to build up the system. 4) Group the elements according to criteria. 5) Give each blob a title or name that indicates the kind of categorisation used. 6) Go up a level and group the groupings. 7) Repeat the grouping until you are ready to draw a boundary around the whole of your system. This would be your top level, and by this point you have probably clarified your thinking about the purpose of the system, so would be able to add a title.
Further information	*Example* Example: http://www.open.ac.uk/skillsforstudy/example-system-map.php *Further information* http://systems.open.ac.uk/materials/T552/

Pairing of researchers and policy makers / cross organisational knowledge sharing	
Introduction	This method consists of pairing scientists with policy makers
Purpose	Pairing can be used to: • help practising research scientists understand the pressures under which politicians & civil servants operate. • help researchers to learn how to contribute directly to the science policy- making process. • give politicians & civil servants the opportunity to forge direct links with a network of practising research scientists (e.g. enhance their knowledge of science and help improve their awareness of issues such as the funding of scientific research and the university career structure.) • give politicians & civil servants the opportunity to familiarise themselves with the process of scientific understanding and topical research and ultimately to be able to bring this knowledge into better informed discussions and decision making The method can have further outcomes such as: joining a science lobbying group and working together on local environmental issues, attending events or writing joint articles
Procedure	Successful cross-organisational knowledge sharing depends on a number of preconditions: • The individuals involved, as well as the organisations, must clearly see a need for cross-organisational knowledge sharing and all partners must benefit. • The organisations involved require sufficient resources, such as time and funding for cross-organisational knowledge sharing, or they have to allocate their immediate resources accordingly. • Cross-organisational knowledge sharing is strongly based on good personal relationships or networks. These relationships form the basis for the necessary trust and confidence. • Those individuals involved, and their organisations have to be strongly committed to cross-organisational knowledge sharing and should not treat it as a side activity. • Intercultural communication skills, open-mindedness and the willingness to learn from others are all important. • Cross-organisational knowledge sharing requires facilitators or brokers, be it organisations or people, who link organisations and people and moderate the communication flows. • A sustainable partnership requires a culture of give and take. If partners feel exploited through cross-organisational knowledge sharing they will retreat.
Further information	*Examples* The Royal Society – a practical case http://royalsociety.org/Royal-Society-Pairing-Scheme-Case-Study/ http://royalsociety.org/General_WF.aspx?pageid=7277&terms=mp+pairing+scheme Parliamentary Office of Science & Technology http://www.parliament.uk/business/publications/research/post/ The Hansard Society: http://www.hansardsociety.org.uk/ Parliamentary Office of Science & Technology (POST) *Further information* http://www.kstoolkit.org/Cross+Organisational+Knowledge+Sharing

Appreciative inquiry	
Introduction	Appreciative Inquiry is a particular way of asking questions and envisioning the future that fosters positive relationships. The idea is to build from what works, rather than focusing on what does not. By acknowledging the contribution of individuals, the method aims to increase trust and alignment.
Purpose	The method can be used for: • strategic and project planning, both internally and externally, with partners and stakeholders • community development • asset mapping • programme assessment, monitoring and evaluation • team-building - helping teams to see a new way of working together • fostering innovation • conflict resolution • network building • fostering positive relationships • increasing trust and alignment
Procedure	The Appreciative Inquiry process is carried out in five main steps: 1. Definition: establishing the focus and scope of the inquiry 2. Discovery: eliciting stories of the system at its best - this is started in pairs, with the stories then shared with larger groups 3. Dream: collecting the wisdom and imagining the future - this includes graphically visualizing the desired future 4. Design: bridges to the future based on the best of the past and the present - groups work to use assets discovered in the second phase to design a plan to create the desired future 5. Destiny: Making it happen
Tips	Appreciative Inquiry has been criticised for privileging a certain type of positive story. Given that negative stories are critical to human learning, this can be viewed as inauthentic or even manipulative, but can also be empowering.
Further information	*Examples:* MYRADA Appreciative Inquiry Project http://www.iisd.org/ai/myrada.htm A Positive Revolution in Change: Appreciative Inquiry http://appreciativeinquiry.case.edu/uploads/whatisai.pdf *Further information* Sharing Knowledge webpage: http://www.kstoolkit.org Michael, Sarah (2005) The promise of appreciative inquiry as an interview tool for field research. Development in Practice. 15 (2), 222-230. ILAC Brief on Appreciative Inquiry in development settings http://www.cgiar-ilac.org/downloads/Briefs/Brief6Proof2.pdf

Story telling	
Introduction	Storytelling can embed tacit knowledge in narratives and share it with others; it can build a shared knowledge base, provide a shared understanding, make sense of past actions and provide for future visions. A specific variety is the *springboard story* (see www.stevedenning.com), which enables the audience to grasp how an organisation or community or complex system may change. A springboard story has an impact not so much through transferring large amounts of information, but through catalysing understanding.
Purpose	Storytelling can increase the potential for sharing knowledge as well as experiences; it offers some advantages in comparison to traditional communication techniques: • It allows for the articulation of emotional as well as factual content; enhancing the sharing of tacit knowledge, which is in general more difficult to share than explicit knowledge. • It provides information about the broader context in which knowledge arises, which may increase the potential for meaningful knowledge sharing. • By grounding facts in a narrative structure, learning is more likely to take place and be passed on • Monitoring purpose (stories can help to make sense of collected quantitative data) Stories can be used to: • develop trust and commitment; convey values, ethics, norms; break down barriers between multidisciplinary or multi-cultural teams; exchange promising practices and lessons learned; aid infrastructure development; and monitor systems In the context of Communities of Practices stories are often used to: • build stronger relationships; recruit new members/participants
Procedure	The detailed implementation can differ according to the purpose and specific setting (e.g. story telling in pairs versus in a group); however, in general the procedure implies 5 steps: 1. Capturing the story: The procedure is started by introducing the theme for storytelling. This could be focused on a specific theme, or on a range of themes. The key is to provide a context in which participants think about and select the story they are going to share. 2. Crafting the story: participants convert their experiences into a story by including predefined basic key information (e.g. purpose, outcomes, main actors). The key aspects could be formulated using a story template as a guide. 3. Telling the story: Participants pair up/gather in groups to tell their stories. 4. Internalizing the story: The listener(s) internalize the story and reflect on what has been told against their own background of experiences; questions may be asked, and interesting aspects may be discussed. This then leads to a shared understanding. 5. Documenting the story: the listener(s) are supposed to take notes for the documentation; they report back to the storyteller what they documented. If necessary, further questions and discussions could follow to come up with a shared understanding
Tips	Good stories are those that are interesting, unusual, provocative, serious, controversial, surprising, intriguing, or inspiring in some way. The story should in general: • be told simply and powerfully; play to what is already in people's minds • be demand driven, and timed to coincide with specific opportunities
Further information	*Example* Colton, S. et al. 2004) Telling Tales: Oral Storytelling as an Effective Way to Capitalise Knowledge Assets http://spark.spanner.org/ul/t/ta_SPARKPRESS_Folders_ASSETS_Current_2003_04_Telling_Tales_dec03.pdf *Further information* Denning, S. (2000) The Springboard. How Storytelling ignites Action in Knowledge- Era Organisations. Butterworth Heinemann / KMCI Press. Steve Denning's website: www.stevedenning.com Lambert, J. (2010) Digital Storytelling: Capturing Lives, Creating Community. Digital Diner. Press, Berkeley, California.

The Art of Story Telling website: http://www.eldrbarry.net/roos/art.htm

Polleta, F. (2005) Contending Stories: Narrative in Social Movements. The Drum Beat, Issue 307, 11 July 2005. www.comminit.com/evaluations/eval2005/evaluations-69.html

Sparknow website: http://www.sparknow.net

Bhardwaj, M., and Monin, J. (2006). Tacit to explicit: Interplay shaping organization knowledge. Journal of Knowledge Management, 10(3), 72-85.

Focus groups	
Introduction	The main difference between focus groups and charrettes is that focus groups discuss an issue or theme together, while a charrette will often break up into smaller groups. A focus group refers to any collaborative session in which a group collectively drafts a solution to a problem. The structure of a focus group varies, depending on the problem and the individuals in the group. Focus groups allow interviewers to study people in a more natural setting than a one-to-one interview. Focus groups have a high apparent validity - since the idea is easy to understand, the results are believable. Also, they are relatively low in cost, can get results relatively quickly, and they can increase the sample size of a report by talking with several people at once (Henderson, 2009). Focus groups may be sensitive to cultural constraints, depending upon the makeup of the group. If group members come from widely different levels of a hierarchy, members from subordinate levels may be reluctant to give their open opinions. Similarly, if participants represent particular institutions, they may be inclined to offer their contributions strategically and valuable insights may be lost. These constraints notwithstanding, focus groups are reasonably straight forward to organise and run. Focus groups are well suited to assessing both past and planned change. Focus groups are often one-off case studies, which means that they are limited in their ability to produce results that are comparable, or that encourage ongoing reflection, or that allow for the monitoring of learning in a network. These limitations can be overcome to a degree if focus group exercises are repeated.
Purpose	Focus groups can help generate a design solution through integrating the aptitudes and interests of a diverse group of people. They can also create a neutral communicative space for stakeholders involved in a problem/issue, where they can talk, inspire each other, harmonise interests, etc. This is a typical tool for action research and many kinds of qualitative data collection. It is particularly useful in the early stages the research, when the appropriate research questions are not fully known because it enables learning from experts about the topic. It is also useful towards the end of a project, when different opinions can be cross-checked.
Procedure	Focus Group is an interview, conducted by a trained moderator among a small group (typically 6- 12) of respondents. The interview is conducted in an unstructured and natural way where respondents are free to give views. Variants of focus groups include: • Dual moderator focus group - one moderator ensures the session progresses smoothly, while another ensures that all the topics are covered • Dueling moderator focus group - two moderators deliberately take opposite sides on the issue under discussion • Teleconference or online focus groups - telephone network or the internet is used • Charrettes: see the next fiche for details.
Resources	Few resources required other than a confident moderator and sufficient participants.
Tips	Focus groups can wander off topic. This is not always bad, since new insights can be found. The moderator needs to know when to intervene. A fundamental difficulty with focus groups (and other forms of qualitative research) is the issue of observer dependency: the results obtained are influenced by the researcher, raising questions of validity.
Further information	Henderson, Naomi R. (2009). Managing Moderator Stress: Take a Deep Breath. You Can Do This!, Marketing Research, Vol. 21 Issue 1, p28-29. Michael T. Kaufman (February 24, 2003). "Robert K. Merton, Versatile Sociologist and Father of the Focus Group, Dies at 92". The New York Times. http://www.nytimes.com/2003/02/24/nyregion/robert-k-merton-versatile-sociologist-and- father-of-the-focus-group-dies-at-92.html

Lynne Ames (August 2, 1998). "The View From/Peekskill; Tending the Flame of a Motivator". The New York Times. http://www.nytimes.com/1998/08/02/nyregion/the-view-from-peekskill- tending-the-flame-of-a-motivator.html?n=Top%2FNews%2FScience%2FTopics%2FResearch

Wikipedia- Focus Group: http://en.wikipedia.org/wiki/Focus_group

Charrette	
Introduction	The term 'charrette' can be understood as the collective noun for a group of focus groups that discuss a common topic. The main difference between focus groups and charrettes is that focus groups discuss an issue or theme together, while a charrette will often break up into smaller groups. Charettes provide a platform for information and opinion exchange. They are a face-to-face process that is a powerful and effective tool for creative and collaborative problem-solving.
Purpose	Charrette is useful to generate consensus among a heterogeneous group of people within a short period of time, and at best creates joint ownership of solutions. It can be used to: • assemble practical ideas and viewpoints at the beginning of a planning process • encourage input and collaboration from a wide range of participants • facilitate decisions on difficult issues when a process is mature • resolve indecision or deadlocks between groups toward the end of a process • develop feasible projects and action plans with specific practical steps for the successful development of projects based upon citizen input • identify potential funding sources for projects This method is particularly appropriate when the nature of the issue indicates a need for group participants in face-to-face interaction in order to stimulate the exchange of ideas and views.
Procedure	The implementation of the charrette process requires a number of steps: 1. The **pre-Charrette** phase focuses on developing and working with a kind of steering committee that determines the primary focus of the Charrette (main issue/problem). The steering committee is also in charge of coordinating the next two phases (establish time-line, meeting schedule, etc.). The pre-Charrette planning breaks the main issue into component parts, to which sub-groups of people are assigned. The subgroups periodically report back to the whole group and feedback from the whole is then addressed in the next round of sub-group discussions. This sequence is repeated until consensus has been reached. 2. **Charrette Workshop**: The Charrette workshop is an intensive planning and design workshop involving participants in assessing needs, interviewing stakeholder groups, prioritising issues, developing recommendations, identifying specific projects and generating implementation strategies. 3. **Post-Charrette**: This phase comprises the preparation of a final document that outlines strengths, challenges, recommendations, specific projects, actions steps and potential funding sources.
Resources	**Time**: this depends on how easily / quickly consensus can be achieved.
Further information	*Examples:* Planning Charrette (Scottish Sustainable Communities Initiative) http://www.scotland.gov.uk/Topics/Built-Environment/AandP/Projects/SSCI/SSCICharretteSeries Elaboration of strategies for financing land conservation efforts, storm water protection, and local greenway efforts. (Shenandoah Resource Conservation & Development Council) http://www.shenandoahrcd.org/ProjCharrette1.htm Design Ideas Charrette: http://www.urbanfarmhub.org/2010/04/at-uw-charrette-designers-turn-blank-canvases-into-productive-urban-farms/ Research Charrette used to engage Industry in Best Practices Research: http://ascelibrary.org/coo/resource/1/jcemd4/v136/i1/p66_s1 *Further information* Corporate Consultation Secretariat, Health Policy and Communications Branch (2000). Health Canada Policy Toolkit for Public Involvement in Decision Making. Minister of Public Works and Government Services Canada. Gibson, G., F. Asce and D. Whittington, (2010) Charrettes as a Method for Engaging Industry in Best Practices Research. Journal of Construction Engineering and Management, 136 (1), 66-75. Participatory methods toolkit: A practitioner's manual (2005); joint publication of King Baudouin Foundation and the Flemish Institute for Science and Technology Assessment (viWTA). http://www.viwta.be/files/30890_ToolkitENGdef.pdf

	Segedy, J. and Johnson, B. The Neighborhood Charrette Handbook: Visioning and Visualising Your Neighborhood's Future. Sustainable Urban Neighborhoods. www.bsu.edu/cbp
	The Charrette: A Uniquely Effective Way of Defining A Proposed Projects' Viability.
	http://home.att.net/~visualizer/Charrette.html, http://www.charretteinstitute.org/charrette.html
	Wikipedia- Charrette: http://en.wikipedia.org/wiki/Charrette

Expert Interview	
Introduction	The expert interview is ideal for presenting content and encourages subject matter experts to share knowledge in an informal, relaxed setting.
Purpose	It is relatively informal and less intimidating than a panel discussion.
Procedure	For a session with 3 experts, place them in front of the audience, 4 chairs on one side (for expert panel) and 2 chairs on the other (for audience member with questions) in the shape of an inverted V. The audience sits in a semi-circle in front of these chairs. Session may run between 60-90 minutes. **The facilitator** • Sets the tone by clarifying the purpose of the session • Ensures the audience is aware of the scope of the guests' expertise • Allows the audience to become experts should they want to answer a question • Introduces and facilitates the question and answer process • Requests that audience members ask concise questions only, with no lengthy preamble • Captures the essence of answers on flipchart paper or cards which are then pinned on boards **Process** • Facilitator introduces the guests/ experts and invites questions from audience. • An audience member with a question walks up to the panel and sits on one of the 2 chairs. The next person with a question can sit on the other chair. This keeps the pace going and reduces pauses between questions from the audience. • Once the question is answered by one of the experts, the audience member gets off the chair and the next one waiting steps up to the first chair and so on. • If any audience member would like to answer a question or add to the expert's answers, he/she walks up to the panel and sits on the empty chair next to the experts, and answers. This keeps the exchange fresh and allows interaction without creating a divide between the experts and the audience. • Facilitator captures major points on flipchart or cards as the session progresses so that the audience may view them. • To close the session, the facilitator thanks the guests/ experts and summarizes the points made using the flipchart/ cards.
Tips	This is a great way to get subject matter experts to share their knowledge in a less traditional setting. Ideal for 2-3 experts only, otherwise it becomes tedious. The extra chair next to the panel of experts gives the audience the message that anyone can be an expert by sharing their know-how. It takes pressure off the experts and also removes any hierarchical connotations.
Further information	Source: http://www.kstoolkit.org/Expert+Interview VIPP handbook

Force Field Analysis	
Introduction	Force Field Analysis is a useful technique for looking at all the forces for and against a plan/a decision. It looks at forces that are either driving movement toward a goal (helping forces) or blocking movement toward a goal (hindering forces), and it helps you to weigh the importance of these factors and decide whether a plan is worth implementing (Lewin, 1997; Thomas, 1985).
	It is possible to design a force field analysis in a workshop setting so that results are comparable by participants considering a common predefined proposal. This should be possible in most settings since the method is intuitively straight forward and free form cultural constraints. Since the method concentrates on a particular change or process, it is readily adaptable to different scales of learning (individual, institutional) and sufficiently flexible for different stages and forms.
	Force field analysis concentrates specifically on process and outcomes but is not intended for ongoing reflection or assessment of change. If that is desired, it should be used in conjunction with another evaluation method.
Purpose	Force Field Analysis is a useful technique for looking at all the forces for and against a decision. In effect, it is a specialized method of weighing pros and cons. The method is useful:
	• when looking at the variables involved in planning and implementing a change • in team building processes, when attempting to overcome resistance to change. • to develop an action plan to implement change • to suggest actions to reduce the strength of the obstacles • determine if a proposed change can get support • identify obstacles to successful solutions • to investigate the balance of power in an issue • to identify the most important people (stakeholders) and groups involved or affected • to identify opponents and allies • to identify how to influence the target group through action planning
Procedure	2) Using adjectives and phrases, describe the current situation as it is now and the desired situation as the vision for the future 3) Identify what will happen if no action is taken 4) List all the driving and restraining forces for the change 5) Discuss the key restraining forces and determine their severity 6) Discuss the key driving forces and determine their strength 7) Allocate a score to each using a numerical scale where 1 is very weak and 10 is very strong 8) Chart the forces by listing, in strength scale, the driving forces on the left and the restraining forces on the right 9) Explore the restraining forces and the best way to address them 10) Explore the driving forces and the best way of advancing them 11) Identify priorities and produce an action plan
Further information	*Example:* Force Field Analysis applied in a school situation: http://www.crossroad.to/Quotes/brainwashing/force-field.htm *Further information* Thomas J. (1985) 'Force Field Analysis: A New Way to Evaluate Your Strategy', Long Range Planning, Vol. 18, No. 6, pp. 54-59. Lewin K (1997): Resolving Social Conflicts and Field Theory in Social Science 12Manage webpage: Analyzing change factors: the driving forces and the restraining forces. Explanation of Force Field Analysis and Diagram. http://www.12manage.com/methods_lewin_force_field_analysis.html Improvement Network webpage: http://www.improvementnetwork.gov.uk/imp/aio/1035279 Overseas Development Institute: http://www.odi.org.uk/rapid/tools/toolkits/communication/docs/forcefield_analysi s.pdf Mind Tools website, Force Field Analysis-Analyzing the pressures for and against change: http://www.mindtools.com/pages/article/newTED_06.htm

Knowledge café	
Introduction	A Knowledge Cafe brings together a group of people to have an open, creative conversation on a topic of mutual interest to surface their collective knowledge, to share ideas and insights and to gain a deeper understanding of the subject and the issues involved.
Purpose	Knowledge Café can be used to share tacit knowledge. It can question assumptions, help facilitate learning from others and gain a deeper collective understanding of a subject – through conversation. Some examples of its application include: • surface hidden problems and opportunities that exist in the organisation or in a department or project - especially ones caused by lack of communication • break down organizational silos • encourage knowledge sharing and the creation of a knowledge sharing culture • build and improve relationships • improve networking and make new connections • solicit input and obtain buy-in for a new project or initiative • as part or replacement for a paper survey or interview (the problem is that until people talk - their knowledge fails to surface) • as a stimulus to innovation: Knowledge Cafes connect people to people; people to ideas and ideas to ideas; they challenge people to reflect on their thinking; surface new ideas and make new connections
Procedure	• A café normally runs for between 90 minutes to a couple of hours • 25 to 35 people is a good number • Any subject can be addressed • Explore questions that matter to the participants • Normally explore only one theme, and pose one question **The role of the facilitator:** • Facilitator need not be a specialist, simply a good listener with chairperson skills • Facilitator should not take a lead in the discussions • Should wander around and listen in to the groups • Should listen out for problems and remind people gently of the rules of 'dialogue' • Don't appoint a leader or chairperson • Everyone should be equal and fully engaged in the conversation • Don't appoint a note taker; anyone can make their own notes if they want to • People share their perspectives with the group, only if they wish to The objective is to hold a group conversation, so the facilitator needs to work with this in mind. They shouldn't play the expert or attempt to lead the dialogue and should try to steer clear of getting involved in the discussions wherever possible – while also encouraging people and providing guidance where necessary.
Resources	Knowledge café can be done anywhere, including at the café itself. The more informal the environment is, the more comfortable people will be and the more they are willing to share ideas and knowledge with others. What you need is: • A group of people • A facilitator or host • A room with plenty of space • Tables and chairs to seat about five people per table. Aim to create a nice ambience – you don't need to have lots of 'props' in the room. The main thing is to provide an informal, hospitable environment in which people will feel comfortable and unthreatened.
Further information	http://www.gurteen.com/gurteen/gurteen.nsf/id/kcafe http://www.kmtalk.net/article.php?story=20061123040304822 http://www.ikmagazine.com/xq/asp/sid.0/articleid.D72A08AF-DDCC-4B46-8909-90D1FF70A0CA/eTitle.QA_David_Gurteen/qx/display.htm

World Café	
Introduction	The World Café is an easy-to-use method for fostering a creative process for collaborative dialogue and the sharing of knowledge and ideas, particularly in large groups. It is a provocative metaphor enabling us to notice the often invisible webs of conversation and social learning which lie at the heart of our capacity to share knowledge and shape the future together. The world café method is not a data collection method but rather a knowledge collation method so it is of limited use for creating comparable results. Similarly, it is not geared towards assessment of change or ongoing reflection on the network or its processes and outcomes. It is particularly applicable in the early stages of a project, since it is suitable for establishing the ground base of knowledge that exists within a network.
Purpose	The method is used in order to: • engage large groups (from 12 persons – up to more than 100) in an authentic dialogue process • generate input, share knowledge, stimulate innovative thinking and explore action possibilities concerning real life issues and questions • engage people in authentic conversation – whether they are meeting for the first time or have established relationships with each other • conduct in-depth exploration of key strategic challenges or opportunities • deepen relationships and mutual ownership of outcomes in an existing group • create meaningful interaction between a speaker and the audience
Procedure	Participants (4-5 people) discuss a question or issue in small groups around tables. Tables should be have coloured pens and paper available in order to document the discussion (could be notes or drawings). A facilitator or moderator introduces the host at each stand. At regular intervals (typically 15 to 30 minutes) the participants move to a new table. One table host remains and summarises the previous conversation for the new table guests; thereby subsequent conversations are cross-fertilised with the ideas generated in earlier conversations with other participants. At the end of the process the main ideas are summarised in a plenary session and follow-up possibilities are discussed. One World Café event may explore a single question, or several questions may be developed, to support a logical progression of discovery throughout several rounds of dialogue.
Resources	The method requires sufficient space and will take about 45 minutes to three hours.
Challenges and Tips	The question(s) addressed in a Café conversation are critical to the success of the event. According to Steyaert et al (2005) it is important to establish an approach of 'appreciative inquiry'. The major premise is that the questions are asked in a way that sets the focus on a specific issue. Knowledge emerges and creativity thrives in response to compelling questions, thus questions should be generated that are relevant to the actual concerns of the participants. People engage deeply when they feel they are contributing their ideas to questions that are important to them. Powerful questions help to attract collective energy, insight and action. Good questions: are simple and clear; are thought provoking; are energy generating; open new possibilities; focus inquiry; and surface unconscious assumptions
Further information	*Examples* Policy meets Research Workshop on Food (CORPUS Project): http://www.scp-knowledge.eu Good Engagement seminar of the Office for the Community & Voluntary Sector (NZ) http://www.ocvs.govt.nz/work-programme/building-good-practice/good-practice-in-action/art-of-hosting.html *Further information* Brown, J. (2002) The World Café: A Resource Guide for Hosting Conversations That Matter. Mill Valley, CA: Whole Systems Associates. Brown, J., Isaacs, D. and the World Café Community (2005) The World Café: Shaping Our Futures Through Conversations That Matter. Berrett-Koehler.

Scholz, H., Vesper, R. and Martin Hausmann, Learning Map No. 2 - World Café, Neuland, http://www.neuland-world.com/CA/literature-accessories/knowledge-maps-2tperknlb76.html

Participatory methods Toolkit: A practitioner's manual

http://www.kbs-frb.be/uploadedFiles/KBS-FRB/Files/EN/PUB_1540_Participatoty_toolkit_New_edition.pdf

The World Café website: http://www.theworldcafe.com

Participatory methods Toolkit: A practitioner's manual: http://www.kbs-frb.be/uploadedFiles/KBS-FRB/Files/EN/PUB_1540_Participatoty_toolkit_New_edition.pdf

Marketplace / Poster exhibition	
Introduction	To offer a space for participants to exhibit their experiences, knowledge, skills and products, and to encourage dialogue and exchange.
Purpose	The Project Marketplace is a chance for participants who have done action-research or project work to showcase learning and outcomes, share knowledge, experience and information.
Procedure	• Groups or individuals prepare a poster at the beginning of the information market and give a short announcement on what the "buyers" can expect. • Everyone is encouraged to visit the displays, talk with each other, ask questions, make suggestions, and offer resources and coaching through a structured process. • After a visiting time of about 30 min to one hour, the plenary meets in the middle of the marketplace and visitors explain what they have "bought" at the market and what further initiatives may result from the dialogue and exchange.
Further information	*Examples* MetroAg – facilitated by REOS http://www.worldofminds.com/projects/metroAG/Global%20Summit%20on%20 Metropolitan%20Agriculture%2029%20&%2030%20September%202010/index.html Research meets Policy workshop (Food I) - CORPUS project http://www.scp-knowledge.eu/sites/default/files/Research_Meets_Policy_Workshop_Documentation_final_0.pdf

Social Return on Investment (SROI)	
Introduction	SROI is a measurement framework derived from social accounting and Cost benefit Analysis (CBA) that helps organisations to understand and manage the social, environmental, and economic value that they are creating. Rather than simply focusing on revenue or cost savings for one stakeholder, the methodology takes into account and values the full range of benefits to all stakeholders. It also seeks to add depth and colour to the derived metrics through the use of qualitative narrative stakeholder consultation to derive a theory of change, through a grounded approach. An SROI analysis produces a narrative of how an organisation creates and destroys value in the course of making change in the world, and a ratio that states how much social value (in £/€) is created for every £1/€1 of investment.
Purpose	It is an outcomes-focussed methodology: in other words it seeks to understand and value the most important changes that occur from an organisation, project or programme, rather than valuing only those things that are easy or straightforward to measure. Second it is designed to be stakeholder driven, relying on consultation with those who are experiencing change and ensuring that recommendations are made to facilitate targeted and effective change for society. Its deliberative and inclusive approach can help programme managers understand their stakeholders better, while those at the coal face of a programme are given the opportunity to learn from and celebrate their achievements, as well as to have a voice. SROI puts social impact into the language of 'return on investment', which is widely understood by investors, commissioners and lenders. There is increasing interest in SROI as a way to demonstrate or measure the social value of investment, beyond the standard financial measurement.
Procedure	The seven guiding principles of SROI are to: involve stakeholders; understand what changes; value what matters; include only what is material; avoid over claiming; be transparent; and verify the result. The main stages of SROI are as follows: • Establishing scope and identifying stakeholders • Exploring and mapping the outcomes • Evidencing outcomes and giving them a value • Establishing impact • Calculating the SROI • Reporting, using and embedding. There are two types of SROIs. *Evaluative* SROIs, which are conducted retrospectively and based on actual outcomes that have taken place over a given evaluation period. *Forecasted* SROIs, which predict how much social value will be created if activities meet their intended or most likely objectives.
Resources	The length of time and resources it takes to carry out an SROI varies significantly depending on the scope of the analysis and the extent to which outcomes data is already available.
Tips	If there are not already good outcomes data collection systems in place, it can be time-consuming to conduct an evaluative SROI analysis the first time around. There is a danger of focusing too narrowly on the ratio. The ratio is only meaningful within the wider narrative about the organisation(s). Just as an astute investor would not make a financial decision based on just one number, the same practice applies to this social measurement tool. SROI is an outcome, rather than a process evaluation.
Further information	***Further information*** Cabinet Office (2009)- Introduction to Social Return on Investment. http://www.disability.co.uk/sites/default/files/resources/Cabinet_Office_Introduction_to_Social_Return_on_Investment.pdf NEF Consulting (2009) A guide to social return on investment. http://neweconomics.org/2009/05/guide-social-return-investment/ Sinzer (2012) The beginners guide to social return on investment. http://cdn2.hubspot.net/hubfs/462118/The_beginners_guide_to_social_return_on_investment.pdf?t=1464948788336 An SROI Primer can be accessed here: http://sroi.london.edu

Participatory spatial econometrics	
Introduction	Participatory econometrics is a way of jointly identifying, collecting, interpreting and processing data. It is well applicable in spatial contexts and covers a wide spectrum of levels of stakeholder involvement. Econometric analyses basically seek to establish inferential relationships or influences that can be derived from the various data used. At a local level, spatial econometrics can shed light on important social, economic, cultural and environmental relationships. The information provided by sound econometric estimates can be highly relevant for regional policy, planning or local policies at municipality level. Therefore, any statistical analysis needs to be done very carefully to avoid wrong conclusions. It is however important that stakeholders understand both, the information content of data as well as the statistical procedures applied. Spatial econometrics is particularly complex as it has to incorporate spatial contiguity effects, such as e.g. environmental impacts from a pollution source in the neighbourhood municipality or the local influence of the price level in cities in close distance. Such kind of spatial analysis deserves a broader understanding as is very relevant when it comes to rural-urban interaction.
Purpose	Participatory spatial econometrics should generate policy relevant information by inferential analysis through the use of local data at small spatial scale. Data and methods are subject to a participatory reflection. It is not that much an approach of statistical sophistication in public authorities but rather awareness raising and better understanding. If data are available from public or commercial providers, reflection should address plausibility, if data are collected by own surveys, the survey methods and the respective questionnaires ought to be subject to participatory reflection, in a way to "take out the con of econometrics" (Leamer 1983). As regards the statistical method it is important to first impart basic knowledge in an illustrative manner. In the end, there should be awareness about advantages but also the limitations of such methods. The objective is that stakeholders understand the estimates, their reliability, and the different steps to obtain such results. Not in all cases estimates are useful and reliable. In participatory econometrics it is not needed to teach the related mathematics (e.g. matrix algebra, stochastics etc.) to a major extent; estimates are basically generated by modelling with software (e.g. Stata, R or similar). The focus is more on the conceptual logic. If estimates appear plausible, conclusions could lead to important policy and planning decisions. If results appear implausible, it could be highly interesting to search for the reasons. Were the data wrong? was the method inadequate? or: have common prior assumptions been false? (That way it becomes the format of citizen science).
Procedure	The most important precondition is the experience and qualification of at least one regional representative in spatial econometrics. Since every partner region is also represented by a research partner this should be ensured. It would be certainly an asset if further representatives have a basic understanding of data analysis and statistical methodology. To prepare a case study elaborated by participatory spatial econometrics the **first step** would be a meeting or local workshop on grid or neighbourhood data available. If such data are not available or deemed unreliable and insufficient, a second workshop on own targeted data collection at neighbourhood level should take place. Topics for both kinds of workshop are: data variance (e.g. comparison means and raw), quality of data, the possible empirical approach (e.g. Budde 2018), the type of questionnaire and what additional data are needed, who can offer such information (prospective interviewees) and the cost-effectiveness of data generation. It could be useful to first experiment with data for educational purposes or a pilot data collection based on stakeholder brainstorming. The selection of the data base and the scope of alternative model specifications should be agreed upon in a participatory manner. In a **second step** the researcher assigned with the tasks will then use the database, will manipulate it for its ready use by the software and will eventually run the different regressions based on the models agreed on beforehand. He or she will then report on the findings and or the problems/limitations and, if necessary, will discuss alternative procedures to be tested. As a **third step**, and as soon as the efforts have produced meaningful results, these are again subject to a discussion in another workshop together with stakeholders. Interpretation of the estimates, plausibility, significance, robustness, and possible consequences are at the centre of the debate: e.g.: "what do those estimates suggest for future local and regional policies?"

Resources	http://rural-urban.eu/publications/what-do-night-satellite-images-and-small-scale-grid-data-tell-us-about-functional http://rural-urban.eu/publications/socio-economic-analysis-urban-rural-continuum-frankfurt-rhine-main-region
Tips	A trained/skilled facilitator would be helpful (e.g. the person(s) who execute the statistical analyses). It may be necessary to offer basic ideas of (spatial) econometrics in an illustrative manner.
Further information	Leamer E (1983) Let's take the con out of econometrics. Am Econ Rev, 73(1) 31-43 Rao V (2003) Experiments in participatory econometrics – Improving the connection between economic analysis and the real world. Econ Pol Weekly, May 18, 2002, 1887-1891 Rao V, Woolcock M (2003) Integrating qualitative and quantitative approaches in program evaluation. In: Bourguignon FJ, Pereira da Silva L (eds.) The Impact of Economic Policies on Poverty and Income Distribution: Evaluation Techniques and Tools. New York: Oxford University Press, 165–190

Appendix 3: Simplified method for the analysis of socio-economic links along the rural-urban continuum

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1. Introduction

The overall aim of policy in democratic market economies is to enhance sustainable welfare. Sustainable welfare comprises more than just income but rather an improving and durable quality of life: Improving due to important technological innovations and durable due to an efficient allocation of natural resources. Since quality of life is also largely affected by subjective and highly individual criteria (e.g. health and mental status, age etc.) it is, however, hard to find a common definition of that category and hence to identify a representative variable for statistical analysis. Disposable income is therefore still the most often used indicator describing welfare. This variable is certainly more meaningful than just GDP *per capita* but it is still far from encompassing something like truly sustainable welfare, especially for highly aggregated data.

Fostering rural-urban synergies (subject of the ROBUST project) is a specific spatial policy thread that aims to enhance welfare through a more effective and resource-efficient use of functional capabilities of cities and rural space. The assessment of rural-urban synergies and the policies supporting their use needs to reflect exactly this relationship and the respective determinants of impact. Therefore, it is essential to shed light on the economic exchange among different functional classes of area. This can be e.g. addressed by an analysis of the local good markets or by a commuter analysis among different functional areas at the local level. While commuter data at municipality level are available in most EU countries there are virtually no such data for trade on local markets (i.e. between municipalities). Trade data are hardly available below the international level. A theoretically possible, but highly demanding and hardly realistic solution could be the application of localised input-output tables and trade flow analyses (e.g. Boero R et al. (2018) Regional input–output tables and trade flows: an integrated and interregional non-survey approach. Reg Stud 52(2) 225-238). In the end, we know that rural-urban linkages are highly important for sustainable welfare, but the forces and mechanisms of those linkages are very difficult to observe. In the socio-economic analysis of the urban-rural continuum of the Frankfurt / Rhine-Main region (Microm data study) an in-depth exploration of rural-urban links at small spatial scale has been addressed by a commuter analysis among different classes of functional space. This sheds light on the rural-urban links on the local labour markets but not sufficiently on the goods and services markets. [3]

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[3] Surveys on local trade would imply to ask every private/public producer or service provider about his/her local and supra-regional outlet markets and intermediary inputs. There are few data sources shedding light on some local market segments, such as tourism (e.g. tourist surveys of municipalities). Local producer associations for direct marketing may also have data on local turnover of their members. But the local data sources are usually rather fragmented.

The simplified method for case studies within the ROBUST project predominantly addresses the *Community of Practice*[4] "new businesses and labour markets" as a determinant of sustainable welfare. But since ideally all CoPs should have a common final overall aim, there is a potential to generalize the approach of the simplified method and to even extend it to the other CoPs. Hence, any CoP is means of policy rather than its end. In annex 1 the rationale and purpose of this deliverable is described.

A major constraint in spatial policies has been an information deficit. Demographic, socio-economic, environmental or political data are provided at an aggregate level, in the best case at municipality level; a halfway sufficiently broad spectrum of variables is provided only at the level of NUTS 2 (larger region, in some cases even whole countries). Hence, averages are given without knowing the spread of the distributions below this spatial level. This hampers policy to target developmental problems precisely enough because such problems materialize at the level of the individual. While the individual is not at all recognizable at the NUTS 2 level, his or her socio-economic life circumstances are much better visible when using data that are provided at the level of the neighbourhood (street block or square kilometer grid)[5]. This applies to descriptive analyses and likewise to inference statistics. Inferential estimations based on averages often largely deviate from respective estimates based on the precise local data. Results might thus distort policy conclusions. Simple examples computed with Excel may reveal this issue (see annex 2). Hence, with data at the level of a high spatial resolution the socio-economy of space will become more precisely visible (like through a lens).[6] Exactly this advantage has been used in the Microm pilot study.[7]

In this study the prior assumption of relationships had been first cast into a theoretical model. This model says that (sustainable) welfare depends on a number of important predictors which are e.g. the strength of the local economy, employment, infrastructure, the history of the social environment, the natural environment and the influence of neighbor communities in terms of Tobler's law[8]. Specifically for business and labour the local density of commercial units (hence the activity level), the level of unemployment and demand-relevant variables may serve as suitable predictors. This was complemented by a commuter balance analysis among municipalities of different areal classes to detect important local push and pull forces between rural, peri-urban and urban area types. Since the overall policy aim is sustainable welfare, the natural environment is part of that aim rather than being a single predictor. This underscores the fact that growth and consumption is limited by depletable resources in the locality (including local ecosystems). To capture this relationship, it is necessary to correctly valuate income with prices that reflect the environmental resilience of the respective locality. If, for example, disposable income in square X is identical with disposable income in square Y, but the environmental resilience in square Y is substantially weaker than in square X, income in square Y needs to be discounted appropriately. With other words: investment into the built environment is

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[4] The CoPs addressed by ROBUST are „New Businesses and Labour Markets", "Cultural Connections", "Public Infrastructure and Social Services", "Sustainable Food Systems" and "Ecosystem Services".

[5] If viewing the grids, not only a more precise variance but also the classification (rural or urban etc.) of the area becomes visible at smallest scale. (See annex 2 how estimates for the same region would differ if means or, alternatively, the respective raw data were used.)

[6] Since in the EU the spatial information on welfare is truncated below the level of districts there has not been adequate and accessible information, neither for targeted local policies and planning nor for socio-economic research of functional rural and urban interaction.

[7] It is therefore worth to communicate the advantage of trustworthy spatial micro-data and the application of reliable statistical procedures such as standard and advanced spatial econometrics in such local contexts.

[8] "Everything is related to everything else, but near things are more related than distant things"

less absorbable in square Y. For the Frankfurt case study, a local variable (spatial impedance) was considered to capture this important relationship and to correct nominal local prices. It was, however, technically impossible to integrate spatial impedance into the stochastic model. Theoretically, a proxy variable showing environmental vulnerability at square kilometer resolution could be linked to disposable income as a discounting factor. We do not know whether such data are also available or accessible for other partner region. Alternative variables capable to illustrate this sustainability aspect could be the level of sealed soil or Natura 2000 areas in the neighbourhood. It is therefore important to screen the local data availability prior to constructing a local model of sustainable welfare. We have to acknowledge that varying data availability among the partner regions could become an issue of eventual comparison.

Departing from that theoretical understanding the use of micro-spatial grid data (in this case combined with commuter data) should contribute to a more precise insight of rural-urban relationships with a view to improve regional, local and inter-municipal policies. The important advantage of such micro-scale data is the fact that the "true" variance van be observed. Estimated results based on means may differ significantly from estimates based on the raw data from that the means are derived (see comment above). Policy decisions suggested, could be quite different.

Bearing in mind that the major bottleneck for local analyses is the varying availability of comparable data at the level of the neighbourhoods in the different case study regions, the empirical approach chosen for the pilot study has been deliberately ambitious. The approach chosen for the pilot case study was to reap the maximum of information contained in the available spatial micro datasets and to conclude which depth of insight can be potentially obtained. Due to the different range and depth of local data among the partner regions, the decision how to methodologically proceed should remain individual and case-dependent. The only common understanding should be the theoretical model, namely the overall policy aim and the fact that different synergetic determinants in the rural-urban space may contribute to it.

It is not at all a necessary condition to apply rigorous spatial econometrics in all case studies. Therefore the following cascade approach of choice is suggested. An important precondition of all methods is their participatory application. [9]

Cascade approach to select a method

(1) No explicit hypotheses based on prior knowledge and literature; Full use of micro-spatial grid data to (i) classify space and (ii) running inferential statistics analyses (spatial econometrics)

(2) Quantitative alternatives: Formulating explicit hypotheses (based on the Frankfurt example, if plausible, or own information); using official data and micro-spatial grid data for descriptive

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[9] In analogy to Participatory Geographical Information Systems (PGIS) this can be also achieved with participatory econometrics (already successfully tested by the World Bank in a Third World context quite long ago, e.g. Rao (2002) or Rao and Woolcock (2003). Econometrics is usually perceived as something complex (because of its often advanced mathematical foundations), but it is in fact something very intuitive and basically a simple method of decision making in daily life (decision making based on prior experience, assumptions and probabilities).

analyses (e.g. spread within municipalities, change over time), running interviews to test hypotheses and results of surveys.

(3) Quantified qualitative approach: Formulating explicit hypotheses (based on the Frankfurt example, if plausible, or own information); running own surveys to gather quantifiable information (e.g. Likert scale); expert interviews to test hypotheses and results of surveys.

(4) Pure qualitative approach: Formulating hypotheses (based on the Frankfurt example, if plausible, or own information), using literature and interviews to formulate narratives.

It could be possible to apply a mix of all methods with a focus on one of them.

The above approach is further discussed below in more detail.

2. Methodological approach of the pilot case study

The task for that has been:

"In-depth analysis of the connections between rural, peri-urban and urban areas and the creation of value added and job growth based on socio-economic data at micro-spatial grid scale of the RVFRM region"

Implementation:

- Classification of rural, peri-urban and urban space based on population density at grid level (by kernel density estimation)
- Identification of spatial and functional relationships within and across the different areal classes (by spatial econometric procedures and a combined commuter analysis)

Database:

- RWI Geo-Grid at one square kilometer grid level (Microm GmbH)
- Data on commuter flows (Federal Employment Agency)
- Data on spatial impedance (Regionalverband Frankfurt Rhein-Main)
- VIIRS images 2012 and 2017 (NOAA)

3. The procedure of the case study

(1) Classification of rural, peri-urban and urban space based on population density thresholds defined by the EU

Functional classification of urban, peri-urban and rural space by *Kernel Density Estimation* of population at grid level
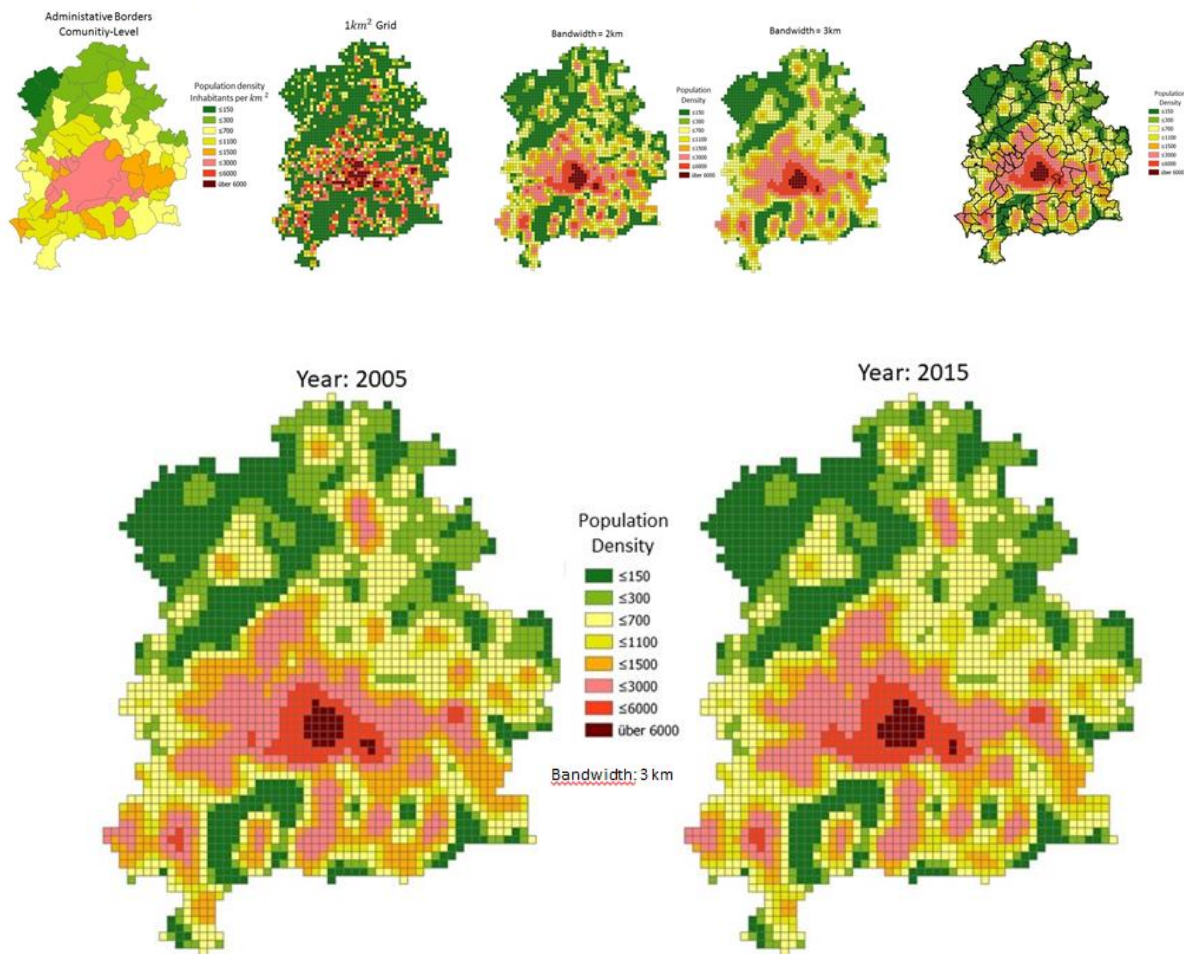
The kernel density estimation can be rather easily executed by GIS (ArcGIS or QGIS). In case of QGIS, the numeric database (geographical coordinates and the related values of the variable) is loaded into the "heatmap" procedure. It is then possible to define the number of thresholds and the optimum bandwidth. The result should be a map of the study region showing a smoothed distribution of different areal classes (urban, peri-urban and rural). The different functional classes can be then compared with the administrative boundaries of municipalities. The variation of spatial classes within single municipalities can be directly recognized.

*(2) Stochastic estimation to determine the strength of factors predicting **disposable income per capita** at the level of one square kilometer scale:*

The core of the analysis has been the estimation of different relevant variables in their effect on disposable income per capita. The choice of covariates is always guided by the theory in mind and the availability of data. For spatial dimensions with restricted data availability (such as grids or street blocks) modelling can become a big challenge if variables do not sufficiently fit the theoretical model. Fortunately, this was not a major problem for the Microm study. In a first step this analysis was done
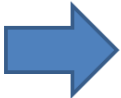
for disposable income alone. In a second step, a variable of spatial (environmental) resilience was added to capture the sustainability dimension.

- Commercial unit density (units per building x 100)
- Share of migrant households (percentage);
- Share of upper middle class and upper class passenger car segments (percentage)
- Unemployment Rate (percentage)
- Households with above-average probability of loan default (percentage)
- Areal class dummy (rural [1; 2], peri-urban [3; 4; 5], metropolitan [6; 7; 8])

The estimation of all those predictors was done by a Spatial Durbin procedure. In addition to the regressor and the predictors this econometric approach also addresses the spatial contiguity influence of every variable regarded.

Estimates largely reflect expected results:

Covariate	+/- strength
Commercial density	+
Migration	+ + +
Upper-class cars	+ + + + +
Unemployment	- - -
Loan default	- - -
Areal class dummy (1-8)	+ + +
Rural dummy (binary)	- - - - -
Peri-urban dummy (binary)	+ + + + +
Metropolitan dummy (binary)	- - -

→ Disposable income per capita

- Commercial density: The impact is lower than expected. The places of residence and work do not usually coincide (Therefore the weak effects are not surprising);
- Migration background: Foreign families' income is usually lower; but their earnings and consumer behaviour contribute to the overall prosperity of a region (a small negative direct effect in addition to a stronger positive indirect spatial effect resulting in an overall positive effect).
- Upper class cars: Vehicles represent status and prosperity, so positive direct and overall effects can be expected. As the neighbouring regions compete with the directly observable units, the overall effect may be slightly reduced by indirect spatial effects.
- Loan default and unemployment: Both imply negative effects on wealth. Indirect positive effects of unemployment might stem from welfare aid consumption from contiguous space.
- Areal class dummy: A positive overall context suggests a reinforcing effect the more densely the areas are populated.

(3) Estimation to determine the strength of factors predicting disposable income per capita under consideration of environmental resilience at the level of one square kilometer:

With a view to consider an extended understanding of wealth in terms of sustainability, a spatial database on so-called "spatial impedance" was explored. These data have been used by the

Regionalverband Frankfurt/Rhein-Main to carry out automatized environmental assessments of investment in the built environment (the so-called "RegFNP-Umweltprüfung"). Spatial impedance reflects the potential environmental and legal conflicts for every point of the area. Since this database is essentially a spatial one the original idea was to combine local purchasing power with spatial impedance as a composite variable. This way spatial impedance could work as a spatially variable discounting factor for local purchasing power. However, it turned out that a technically proper solution within a stochastic model is not possible. While the Microm database has a constant resolution of one square kilometer, spatial impedance is based on a spatially variable resolution, 95 percent smaller than one square kilometer. Because of that some surfaces are then assigned in parts to different grids. To scrutinize the information content of spatial impedance within the socio-economic context, the partial areas lying in a grid were combined according to their environmental categorization. The spatial distribution of the classified areas could be then analysed with respect to population density but it was not possible to relate it to disposable income. A further analysis of correlation between spatial impedance and the socio-economic Microm variables did not suggest any significant relationship. Instead, a descriptive spatial analysis of spatial impedance was carried out. It shows that the proportion of heavy environmental and legal conflict areas in the Frankfurt/Rhine-Main metropolitan region is fairly low. The shares of the total area are all well below 10%, and in most population classes even below 5%. The result as such would suggest environmentally stable preconditions with substantial scope of further environmentally low-risk investment in construction and transport infrastructure. Since this data-based finding seems to contradict environmental realities in the region regarded it is not recommended to determine policy conclusions from the spatial impedance data, at least in this context.

(4) Commuter balance analysis

Entire region:

- The commuter balance of the entire RV region is positive and further growing (surplus 2005: 206,000; surplus 2015: 219,000)
- Share of people living and working in the same municipality slumped from 38 to less than 36 percent (2005-2016)

Areal class level:

Based on a cluster analysis, the 75 municipalities were assigned to 7 groups based on comparable population structures within administrative boundaries (functional variation within municipalities). It was intended to show the commuter flows among different classes of functional areas.

The results for 2015 are as follows

Year:2015								
Group	**Number**	Departed from Group x Figures are % of all incoming commuters						
incoming commuters		1	2	3	4	5	6	7
1	35347	15,6	67,9	5,6	4,2	1,5	4,5	0,6
2	367796	17,3	64,9	5,2	5,4	2,0	4,6	0,6
3	8936	17,2	55,7	4,5	5,8	2,8	9,5	4,5
4	7553	13,5	52,7	4,8	10,2	6,7	11,4	0,6
5	3008	9,5	50,6	4,8	12,4	4,5	16,8	1,4
6	5030	12,0	32,4	10,5	2,7	2,7	26,4	13,1
7	299	3,7	10,7	23,4	0,0	0,0	41,5	20,7
Group	**Number**	Arrived from Group x Figures are % of all outgoing commuters						
outgoing commuters		1	2	3	4	5	6	7
1	72475	7,6	87,6	2,1	1,4	0,4	0,8	0,0
2	274897	8,7	86,8	1,8	1,4	0,6	0,6	0,0
3	22500	8,8	84,5	1,8	1,6	0,6	2,4	0,3
4	23079	6,5	85,7	2,2	3,3	1,6	0,6	0,0
5	8905	6,1	82,3	2,8	5,7	1,5	1,5	0,0
6	22350	7,1	76,4	3,8	3,9	2,3	6,0	0,6
7	3763	5,5	62,3	10,7	1,2	1,1	17,6	1,6

	Highest score of commuters in %
	2nd highest score of commuters in %

- Groups 1 and 2[10] are closely connected. More than 77% of commuting in the Frankfurt / Rhein-Main area takes place between the municipalities belonging to those two Groups.
- The relation of incoming to outgoing in Group 2 is 1.33. In all other groups the balance is < 1.
- Commuting between Groups 5 to 7 is more isolated; exchange with the core groups 1 and 2 is less pronounced. A reason might be longer distance and worse accessibility/public transport

(5) Analysis of correlation with VIIRS night satellite imagery:

Further to the spatial econometric estimation and the micro-spatial commuter balance analysis, an analysis of the strength of association between (i) population density and (ii) commercial unit density with respect to light emission (VIIRS) at one square kilometer level was executed to explore patterns of association for the different areal classes.

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[10] Group 2 comprises the larger cities Frankfurt, Offenbach and Hanau plus Main-Taunus-Kreis, while group 1 largely consists of municipalities south of Frankfurt
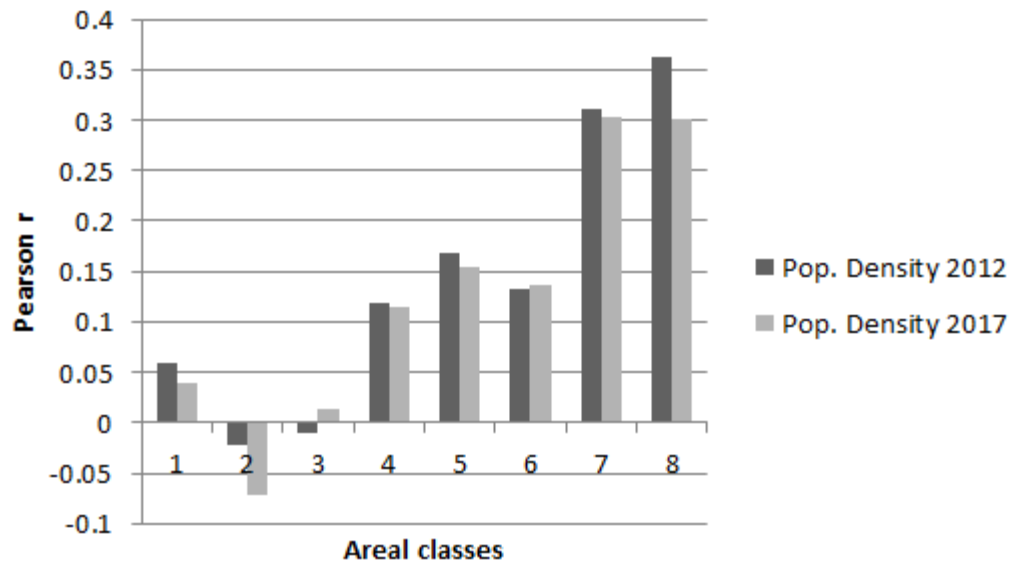
For (i), *Pearson r* is moderate, but increases with population density. As regards the comparison between 2005 and 2015 there is some minor variation that might stem from the correlation analysis with data from different years. In case of the earlier estimate the difference is seven years, hence only the later estimate 2015/2017 appears meaningful.

As regards (ii) commercial unit density the association among the different areal classes appears different as compared with that of population density.
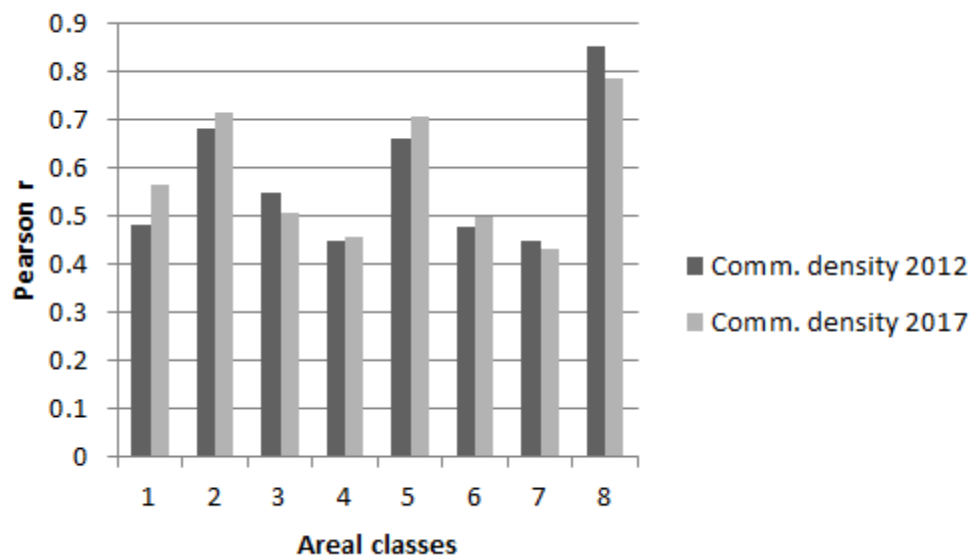
It shows a stronger correlation than for population density but less variation of *Pearson r* and with maxima in class 8.

What does the Microm data study show?

- It precisely detects socio-economic patterns at small spatial scale (one square kilometer grid) including environmental limits of local resource consumption
- It shows classification of functional space based on population density (eight urban, peri-urban and rural classes of space)
- It shows the association and spatial cause & effect relations for several variables at neighbourhood scale (one square kilometer resolution)
- It can be linked to a commuter flow analysis by clustering municipalities along their functional variation
- Population density correlates stronger with light emission only in urban areas (class 7 and 8)
- Commercial density correlates significantly with light emission, thus well defining light emission as a variable showing economic activity

In how far can rural-urban synergies and dependencies be shown?

- Classification of functional space by kernel density estimation;
- Spatial synergies/dependencies for the variables purchasing power – unemployment rate – commercial density – migrant – car class preferences – credit worthiness;
- Rural-urban synergies by commuter balance analysis along spatial classes;
- Population density, purchasing power & business unit density merged with environmental grid variables (to allow for sustainability analysis)
- It shows cause-effects relations under consideration of spatial autoregressive effects for the dependent variable and for all covariates

4. Alternative methodologies for other case studies

Those empirical results structured above are certainly not representative for every case study region. Nevertheless the results may be used as hypotheses to be tested, i.e. an analysis in how far similar relationships can be assumed and also established for other case studies.[11]

If similar grid data are available, it would be recommendable to run similar statistical procedures like that for the Frankfurt region. The prerequisites of such a quantitative study at high spatial resolution level are data availability (socio-economic and environmental grid data), availability of GIS and statistics software (e.g. ArcGIS, QGIS, Stata, R) and some knowledge of geo-statistics & spatial econometrics. But those grid data – if available - should be at least used for descriptive analyses that could help to verify or falsify prior hypotheses (comparative distribution among different areal classes, means, spread). In such cases, standard spreadsheet software could be sufficient. If data on inter-municipal commuter flows are available their use would significantly improve the information on rural-urban linkages on the labour and local goods markets.

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[11] Empirically evident covariance and cause-effect relations of variables can be taken as prior hypotheses for other case studies (if plausible for the respective partner region and useful)

In case of such grid data not being available to a sufficient extent (or not accessible) it could be also possible to run own surveys among stakeholders with a precise knowledge of the socio-economic and environmental situation at the neighbourhood level. The preparation of such surveys needs to be done with utmost care. A possible approach could be a pre-tested questionnaire for every municipality stating the official averages of any important socio-economic variable (i.e. GDP per capita at NUTS 2/3 level, unemployment etc.). The respective question should then address the deviation from those averages for the municipality and its different local centres (e.g. by Likert scale scoring with percentages or quantiles). The final result of a sufficient number of questionnaires would be a quantifiable qualitative information base. This would allow a similar spatial depth of analysis, however with more risk of error than the pure data based analysis. If further literature or studies (also local news articles) are available for the respective region such information should be used to examine or complement the information collected.

A final alternative could be a purely qualitative testing of hypotheses. This would require a sufficient number of interviews with informed stakeholders at the level of the municipality. The final information would be a densified collection of facts that are subsequently cast into narratives. In addition to the considerable research effort as grassroots level the major disadvantage of this method is the difficulty in distinguishing between opinion and truth. Finding results coming close to empirical facts might become tricky. This can happen when highly politicized issues are addressed, such as migrants[12]. Again, if further written information is available for the respective region it should be used to examine or complement the own information collected. In order to ensure a sufficiently reliable qualitative information base for narratives reflecting the truth of socio-economic circumstances at the neighbourhood level, the number of interviews needs to be high enough. Thus, proper field work could be rather costly and time-consuming.

The only precondition for all cases studies is a coordinated research interest and similarly structured hypotheses to be tested.

5. Recommended structure of a report

For the case studies the structure of the reports should be standardized as much as possible. In the end, this helps to ensure comparability of results irrespective of the individual method applied at the level of the partner regions.

A standard structure could be the following one, as used for the majority of empirical papers submitted to refereed journals:

   I.   Thematic focus & and leading research interest
   II.   Core prior hypotheses to be tested
   III. Methodological approach (quantitative, quantified qualitative information, pure qualitative/narrative)

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[12] A prior hypothesis stating that migrants predict more local welfare might be offensively disputed by interviewees with more xenophobic attitudes.

IV.   Data availability / information base

V.   Results (along variables/relationships/cause-effect patterns/themes)

VI.   Discussion

Such a standard reporting structure should first help to better plan the empirical method (what do we want to know? what do we already know? which information sources do we have? which techniques do we have to answer our questions?). The standard approach of empirical papers has proved to be quite useful for prior reflection and later research guidance.

6. National and EU Data sources

For most countries with ROBUST partner regions small-scale spatial data covering population and the environment are available. Thus a comparable classification of space is possible. Alternatively or in addition to that, classification of space can also be done by cluster-analytic spatial segmentation based on night satellite images.

The following list of data sources is not exhaustive.

Netherlands: grid data on population:

https://www.cbs.nl/nl-nl/dossier/nederland-regionaal/geografische%20data/kaart-van-100-meter-bij-100-meter-met-statistieken

Latvia (data at municipality level):

https://www.csb.gov.lv/en/statistics/search?product_type[map_spacial]=map_spacial

Employment by actual workplace in 2016

Nodarbinātība pēc faktiskās darba vietas 2016. gadā
Employment by actual workplace in 2016
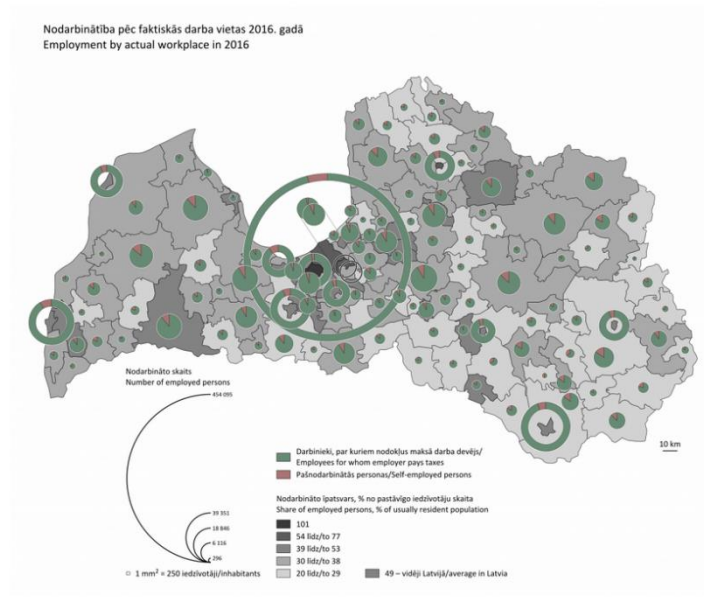
Austria (socio-economic neighbourhood data):

https://www.integral.co.at/de/sinus/geomilieus.php

Germany (socio-economic grid data):

https://www.microm.de/produkte-loesungen/daten/geodaten/raster-grid/

Germany (environmental and land use grid data):

http://www.ioer-monitor.de

Slovenia (population grid data):

http://gis.stat.si/index.php
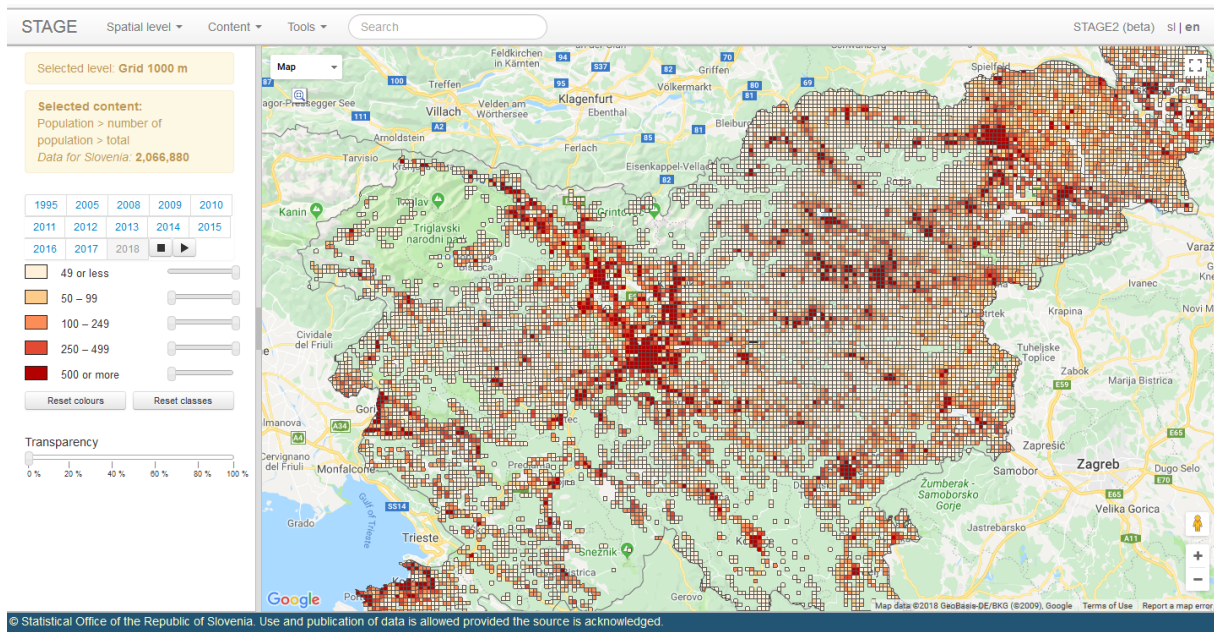
Finland:

http://www.stat.fi/org/avoindata/paikkatietoaineistot_en.html

Portugal:

http://geogrid.ine.pt/
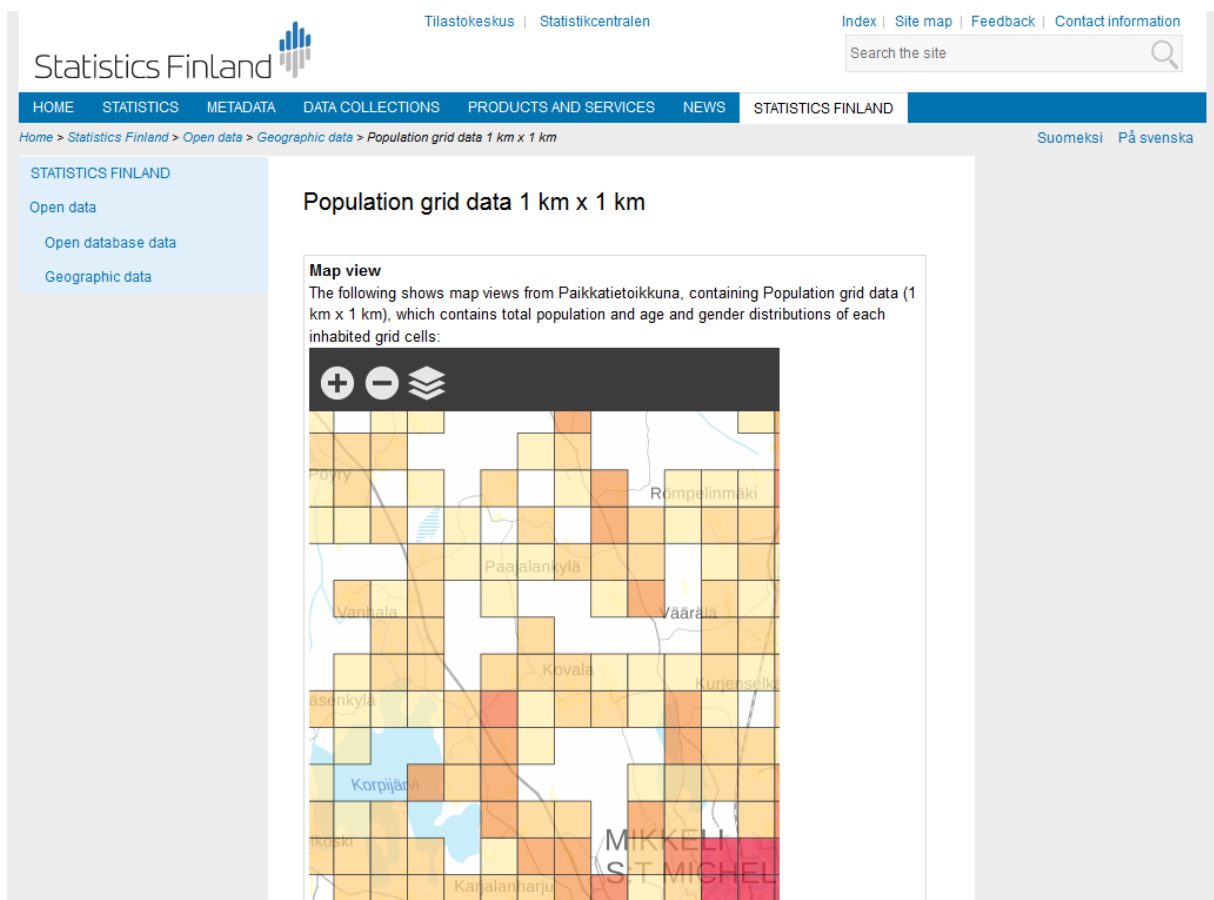
EU and global level:

Eurostat: Population Grids on 1km2 Basis, 2006 and 2001:

https://ec.europa.eu/eurostat/web/gisco/geodata/reference-data/population-distribution-demography/geostat

European Environment Agency: Table text Reference grid for each European Country. (INSPIRE-BASIS)

https://www.eea.europa.eu/data-and-maps/data/eea-reference-grids-2
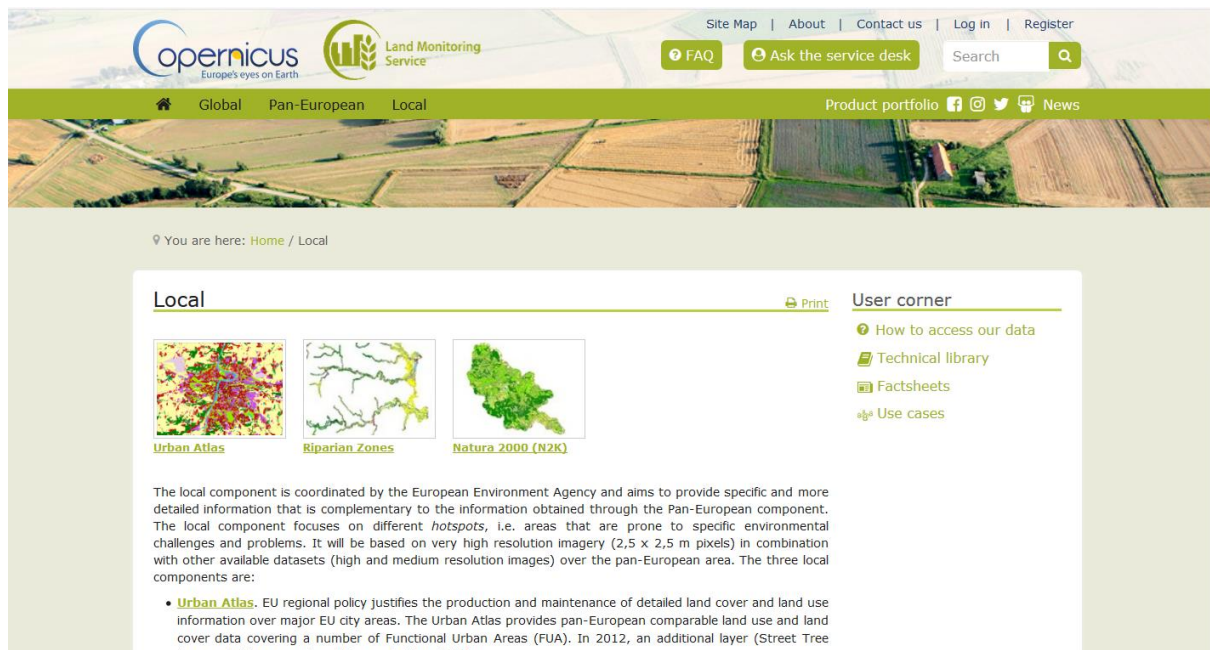
Copernicus Data (Pan-European Land-use: Corinne Land Covers, High Resolution Layers, European Settlement Area, partly from 1990 onwards):

https://land.copernicus.eu/pan-european
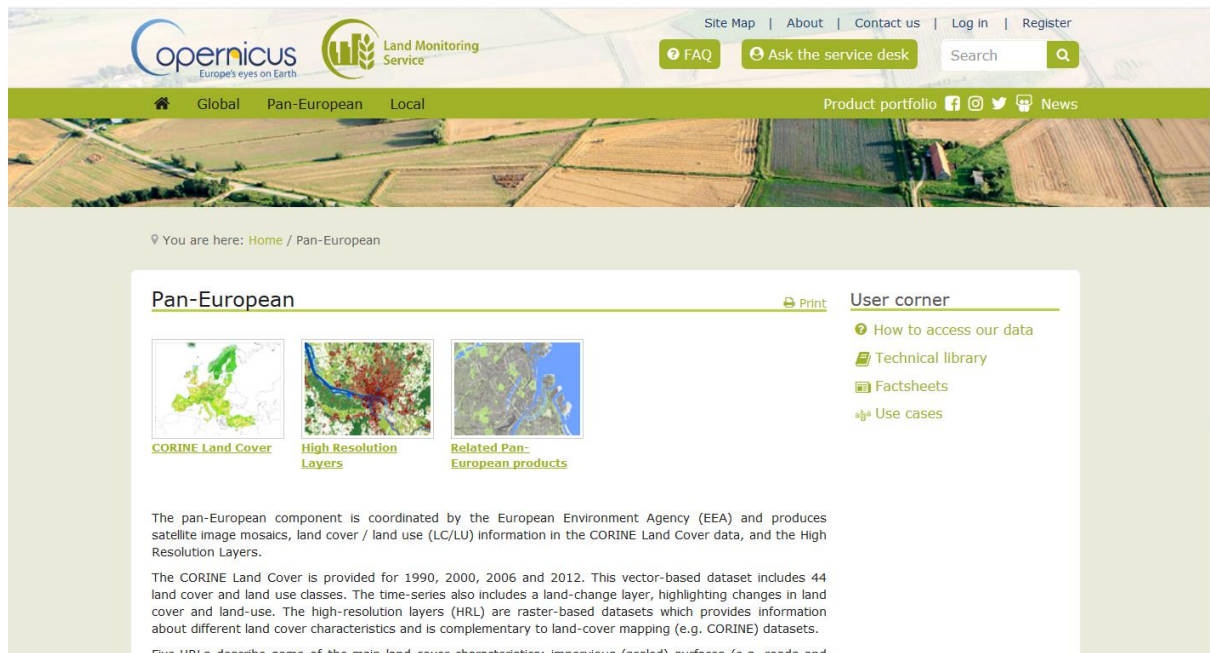
Copernicus Data (Local Data: Urban Atlas, Riparian Zones, Natura 2000 (N2K)

https://land.copernicus.eu/local

Nocturnal satellite imagery (VIIRS composites):

https://ngdc.noaa.gov/eog/viirs/download_dnb_composites.html

Annex 1: Task and purpose

"Task 2.4 Elaborating and piloting a method for assessing how linkages between urban and rural activities affect socio-economic development and specifically the creation of added value and jobs
Months 12-14; Task leader: PRAC with RWI as a contractor (service contract)

Socio-economic development goals will be important in the analyses related to the domain 'New businesses and labour markets'. In Task 2.4 a method will be elaborated and tested that will help to understand how linkages between urban and rural activities affect the distribution of value-adding production steps and the creation of added value and jobs and the implications these link-ages have for the rural economy. Suitable indicators and performance parameters will be developed. For that purpose an in-depth exploration of socio-economic variables at micro-spatial scale (neighbourhood) will be carried out to monitor the evolution of functional linkages around the private sector and employment in the German case study region. Connections between share of commercial estate, level of purchasing power, demographic structure, unemployment rate and other variables can be made visible with the *microm* database. For that purpose PRAC will collaborate with the Rhine-Westphalia Institute of Economic Research (RWI) as a contractor (service contract). On the basis of Task 2.4 a simplified method for the analysis of rural-urban links in the area 'New businesses and labour markets' will be developed, to be applied in WP3 in the case study areas where this theme is prioritised. The results of Task 2.4 will be summarized in a discussion paper and a methodological guideline. "

Annex 2: Simple statistical estimation example: Regression results with high data resolution compared to results with a respective low resolution:

Data of X and Y in high resolution (e.g. grids or street blocks) vs. a resolution with means of X and Y (X_m and Y_m; e.g. at municipality level)

Y	X	Ym	Xm
17	1.9		
15	1.9		
23	1.4		
14	3.4		
21	1.9		
20	1.8		
19	1.8		
12	3.7		
11	3.8		
19	1.9		
12	3.8		
15	2.9		
23	1.5		
35	0.7		
13	3.1		
11	3.2		
19	1.8	18.3	1.7
22	1.5	18.5	2.2
25	1.2	15.3	2.9
12	3.1	19.7	2.3
10	3.8	17.6	2.3

$Y = 30.88 - 5.6*X + u$	$Y_m = 23.73 - 2.5*X_m + u_m$
$R^2 = 0.82$	$R^2 = 0.45$

Coefficients and constants differ. Further to that, the goodness of fit of the estimation with grid data is substantially stronger. This might become a problem in case of high numbers of observation. Then significance and R^2 will tend to be high in both estimations even though estimates may still differ considerable. The underlying reason for that is varying variance among the aggregated units.