Public Engagement Innovations for Horizon 2020

Pilot report on Living Lab of Global Change Research

Authors:
Maria Pietilä
Kaisa Matschoss

Contributors:
Timo Aarrevaara
Jussi Heinonsalo
Minna Kaarakainen
Iina Koskinen
Markku Mattila
Mikko Rask
Tanja Suni
Janne Wikström

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no [611826]

The PE2020 Project

Year of implementation:	February 2014 – January 2017
Web:	http://www.PE2020.eu

Project consortium:

UNIVERSITY OF HELSINKI	UH	University of Helsinki, Finland
	VU IBS	Vilnius University International Business School, Lithuania
LSC	LSC	Laboratorio di Scienze della Cittadinanza, Italy
UNIVERSITY OF LAPLAND LAPIN YLIOPISTO	ULapland	University of Lapland, Finland

Contact information: Timo Aarrevaara, timo.aarrevaara@ulapland.fi
Grant agreement no: 611826
Project acronym: PE2020
Project full title: Public Engagement Innovations for Horizon 2020
Project funding scheme: Seventh Framework Programme, Collaborative Project, Small or medium scale focused research project, SiS.2013.1.1.1-6: Tools and instruments for a better societal engagement in "Horizon 2020"
Project co-ordinator: Mikko Rask, Consumer Society Research Centre at the University of Helsinki
E-mail: mikko.rask@helsinki.fi
Project website: www.PE2020.eu

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no [611826]

The PE2020 project

PE2020 will identify, analyse and refine innovative public engagement (PE) tools and instruments for dynamic governance in the field of Science in Society (SiS). PE2020 analyses the PE tools and instruments through a systemic and contextual perspective, and contributes to the potential and transferability of new governance innovations. PE2020 will create new knowledge of the status quo and trends in the field of public engagement in science, refine innovative PE tools and instruments and propose new ones.

The project will do this by (1) further developing a conceptual model that provides a systemic perspective of the dynamics of public and stakeholder engagement; (2) creating an updated inventory of current and prospective European PE innovations; (3) context-tailoring and piloting best practice PE processes related to the grand challenges of the Horizon 2020 and (4) developing an accessible net-based PE design toolkit that helps identify, evaluate and successfully transfer innovative PE practices among European countries.

New tools and instruments for public and societal engagement are necessary to boost the quality, capacity and legitimacy of European STI governance and to solve the looming problems related to the grand societal challenges of the Horizon 2020. In order to ensure practical relevance, the project will work through intensive co-operation between researchers and science policy actors. PE2020 will expand the capacity of European and national science policy actors to integrate better societal engagement by providing an easy access to new PE tools and instruments, to be included in the requirements and implementation of research in Horizon 2020 and beyond.

Acknowledgements

The author/s and the whole project consortium gratefully acknowledge the financial and intellectual support of this work provided by the European Union's Seventh Framework Programme for research, technological development and demonstration. This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no [611826].

The PE2020 project consortium warmly thanks the following people for their valuable contribution to the PE2020 project: Secretary General for Future Earth Finland PhD Tanja Suni (University of Helsinki), Science Secretary for Future Earth Finland MA Iina Koskinen (University of Helsinki), Chair of Future Earth Finland Professor Markku Kulmala (University of Helsinki), Stakeholder Coordinator for Future Earth Finland PhD Jussi Heinonsalo (University of Helsinki), Dr. Seija Kulkki (Aalto University), Research Director Dr. Petra Turkama (Aalto University), and especially we would like to thank the participants at the Context tailoring workshop in Helsinki, Future Earth Town hall Meeting in Helsinki and the Future Earth Finland Living Lab meeting in Tampere.

Legal Notice

Contents

1 Introduction

The Living Lab of Global Change Research was chosen as a pilot initiative for the PE2020 project in order to deliberate on the possibilities to support and strengthen multi- and interdisciplinary, multi-actor research collaboration related to solving societal challenges, and to elaborate on the possibilities how intermediary organisations may strengthen inter- and multidisciplinary and multi-actor collaboration and support the continuity of living labs.

The Living Lab of Global Change Research was considered a suitable pilot initiative for the PE2020 project as the aims of the partner organiser, Future Earth Finland, were to define priorities for global change research and to co-design global change research questions and projects in collaboration with researchers in both natural and social sciences, actors in the public sector (civil servants, research funders, policy-makers), private sector actors, interest groups, non-governmental organisations, and members of the civil society. As the development of the living lab relies on creating new types of dialogical long-term collaboration patterns and interaction, the creation of the living lab was of interest to the PE2020 project.

The rationale for launching the Living Lab of Global Change Research stems from the pressures emerging from large-scale societal challenges that transcend boundaries of traditional academic fields. There is a need to understand interlinked, large-scale changes in environment and societies which cannot be studied solely from a perspective of one discipline. For example, the changes in climate, biodiversity, agriculture and energy are interlinked, which calls for collaboration between researchers in human and natural sciences.

The need for more collaboration between different actors is justified also by the vast impacts of the global change phenomena on both the physical environment and the society. The magnitude of potential impact calls for opening up the processes of research to more dialogue and debate among diverse stakeholders and members of the civil society (e.g., Owen et al. 2102). Many of the needed reforms towards sustainability may be related, for instance, to changing production processes applied by industry or changing the behavioural patterns of consumers. Thus, solving the challenges requires input and commitment from various actors, such as policy-makers and members of the civil society.

The impact of large-scale challenges transcends also the borders of different countries. While the phenomena of global change transcend national borders, the effects may still be most visible at the local and regional levels. This makes it vital to simultaneously collaborate at the international, national, and local level.

2 Methods

2.1 Objectives of the pilot project

The objectives of this pilot initiative were twofold:

- to deliberate on the possibilities to support and strengthen multi- and interdisciplinary, multi-actor research collaboration related to solving societal challenges;

- to elaborate on the possibilities how intermediary organisations may strengthen inter- and multidisciplinary and multi-actor collaboration in the co-design of research priorities and support the continuity of living labs.

2.2 Method of the pilot project

This pilot initiative tested *the living lab* as a public engagement method (Deliverable 1.1, 45). As the PE2020 report D1.1. specifies, living labs are co-creation spaces, which bring together researchers, stakeholders and public representatives to co-create new services, products and societal infrastructures in real-life settings. Overall, living lab refers here to the general philosophy behind the collaborative global change network activities.

The living lab concept stems originally from innovation studies, where it refers to experimentation and validation environments that are characterised by early involvement of user communities, who work together with developers and other stakeholders (Schaffers & Kulkki 2007, 31). The living lab concept is linked to general developments in innovation activities towards more collaborative working methods and a focus on clients and users instead of focus on experts and established hierarchies.

Furthermore, the living lab perspective is connected to attempts to add value in emerging rather than established markets and to endeavours to utilise ideas of 'democratic innovations' and crowdsourcing (e.g., von Hippel 2005). Von Hippel contrasts user-centred open innovation processes with traditional processes, in which products and services are developed by manufacturers in a closed system. When people are regarded as sources of innovation, demand for certain technology comes to partly determine developed technology.

Whereas co-design and co-production ideas have been extensively applied in the innovation context, opening up the processes at an early stage for a wider audience is innovative in the field of academic research. Because living lab is a new approach to design research priorities and projects in the academic environment, in the pilot project, it was expected to raise interest and enthusiasm among different actors.

The Living Lab of Global Change Research builds on early stakeholder involvement, active collaboration, and learning by experimenting (cf. Schaffers & Kulkki 2007). By bringing together various stakeholder groups to co-define research priorities and to co-create projects and research questions, this pilot initiative represents upstream engagement. According to Rogers-Hayden and Pidgeon (2007), upstream engagement may avoid the usual criticism targeted at public engagement that it occurs too late in the research process, when controversial social or ethical questions have already risen. When public engagement occurs late, it may serve token values instead of influencing the direction that research and innovation takes. This pilot initiative aims at power-sharing between different societal groups. If successful, upstream engagement may balance between corporate and civil society interests and control (Rogers-Hayden & Pidgeon 2007, 357).

The stakeholder groups were collected together in the form of two global change town hall meetings. Town hall meetings are usually organised with the objective to give as many people as possible an opportunity to speak and voice their opinion. Here a smaller scale town hall meeting gave advice to policy makers and research funders on what topics should be prioritised in global change research. (For an example of a town hall meeting, see the deliverable D1.2 of the PE2020-project, 157.)

2.3 Context of the pilot project

2.3.1 The partner

The PE2020 partner and research host for the Living Lab of Global Change Research was Future Earth Finland – Finland's National Committee for Global Change Research[1]. The committee promotes interdisciplinary global change research, which has an impact on society. Organisationally, the committee has a chair and a steering group, which consists of researchers in different disciplines (encompassing both natural and social sciences) and end-users of science representing key stakeholder groups (ministries, municipalities, industry). The committee has a secretariat of two full-time staff and one volunteer stakeholder coordinator, who work in the Department of Physics at the University of Helsinki. The members of the secretariat have been the contact persons for PE2020 WP3.

As the topic of global change is by definition global, the Finnish national committee collaborates continuously with its international partners, including its fellow national committees abroad and their regional clusters. The national committees' task is to implement the objectives of the Future Earth global change research programme, which is coordinated by a globally distributed secretariat and consists of a Science Committee, an Engagement Committee, scientific core projects, and national committees.

Future Earth is a 10-year international research initiative, which will develop the knowledge for responding effectively to the risks and opportunities of global environmental change and for supporting transformation towards global sustainability in the coming decades. Future Earth provides an international platform for coordinating new interdisciplinary approaches to research and a platform for generating knowledge in partnership with society and the users of science. Thus, engagement and collaboration are at the core of Future Earth. Future Earth has a governing council which consists of members from the International Council for Science (ICSU), International Social Science Council, the Belmont Forum of funding agencies, the Sustainable Development Solutions Network, United Nations Education, Scientific and Cultural Organisation (UNESCO), United Nations Environment Programme (UNEP), United Nations University (UNU), and World Meteorological Organization (WMO).

The Finnish national committee was launched in 2014 by the Council of Finnish Academies, which represents the Finnish academies of science in international scientific organisations and promotes the international visibility of Finnish science. The Finnish Living Lab of Global Change Research is also financially supported by Maj and Tor Nessling Foundation, private funder in Finland which funds research related to environmental protection.

It is argued that the broad topic of global change research needs an integrated perspective and needs to feed into greater societal impact by engaging stakeholders in different phases of research processes related to sustainable development: in designing research questions, analysing problems, and in disseminating the results. Future Earth Finland positions itself as a necessary intermediary organisation between the scientific community and the stakeholders. As an interdisciplinary and multi-actor network, the aim of the Living Lab of Global Change Research is to create an interface between research, decision-making, business, and civil society.

[1] If not stated otherwise, the descriptions of the Living Lab of Global Change Research are based on discussions with the Future Earth Finland's secretariat, the website of Future Earth Finland and Future Earth, and presentations at various events.

2.3.2 Preparation and planning

The implementation of the living lab is divided into three levels. At the preparation phase, the aim is to identify relevant partners, to build partnerships, and to commit them to the living lab. The first level is devoted to developing a common understanding of global change as a phenomenon from the perspective of the Finnish society. The second level consists of networking events which aim at creating a mutual understanding of stakeholder and researcher needs and viewpoints. The third level is experimental, testing co-design and stakeholder engagement strategies and methods in pilot projects. At each level, stakeholder-researcher interaction methods are continuously evaluated and improved according to feedback from the users in the living lab, the stakeholders and researchers. The PE2020 pilot initiative focuses on the first and second levels of the living lab.

The preparation and planning of the pilot initiative started in early 2014 with joint discussions between the PE2020 and the secretariat of Future Earth Finland. These discussions revolved around the possibilities for testing public engagement methods in the launch of the global change network in Finland.

The report 'Inventory of PE mechanisms and initiatives D.1.1' (Deliverable 1.1) prepared during WP1 of PE2020, which comprised an up-to-date summary of mostly European and American PE innovations, was used in identifying innovative PE methods that could be applied and tested in the context of the global change research.

Public engagement initiatives which raised particular interest among the Future Earth Finland secretariat were the living lab, gatekeeper analysis method, participatory budgeting, and examples of citizen science. Over the course of discussions, it was agreed to concentrate especially on the living labs approach as it fitted the needs of PE2020 and the Future Earth Finland by entailing dialogue and experimentation among different actors in the field. Furthermore, the gatekeeper analysis method (Deliverable 1.1, 116) raised also particular interest by emphasising the need to identify the relevant key actors related to the complex phenomenon of global change. It seemed crucial to identify the relevant gatekeepers and to commit them in the activities of the global change network.

In addition, the context tailoring workshop on living labs as a public engagement tool organised on the 9th of April, 2015 in Helsinki in collaboration with partners at the Aalto Business School's Center for Knowledge and Innovation Research (CKIR) contributed to designing the pilot initiative. The workshop provided the secretary of Future Earth Finland a discussion forum to deliberate on the possibilities and challenges in creating and maintaining multi-actor, multidisciplinary living labs. The workshop also provided the organisers a chance to learn about experiences of European living labs operating in the innovation and business context and provided new contacts at the national and European level in order to share experiences of co-design and co-creation.

Furthermore, during spring and fall 2015, PE2020 provided an opportunity for the Future Earth Finland secretariat to participate in a national public engagement seminar and to be involved in three real-life public engagement exercises applying the so-called CIVISTI method. The exercises took place in the context of the 'Public Participation in Developing a Common Framework for Assessment and Management of Sustainable Innovation project (CASI)[2]. They included two citizen panels and one expert panel. As the

[2] CASI is a project supported by the Science in Society Programme of the Seventh Framework Programme, Theme SiS.2013.1.2-1 'Mobilisation and Mutual Learning (MML) Action Plans: mainstreaming Science in Society actions in research'.

panels focused on identifying future visions and research priorities for sustainable development at the European level, the topics coincided with the aims of the Living Lab of Global Change Research. These events gave the secretariat a chance to reflect more generally on the needs for public debate and interaction about societal challenges and the difficulties involved (e.g., some citizens' lack of sufficient knowledge about scientifically complex phenomena). The purpose was also to build necessary capacities of the secretariat to organise and run public engagement exercises in the living lab.

2.4 Realisation of the pilot project

PE2020 supported the creation of the living lab foremost by providing input on different ways to engage citizens and stakeholders in the two large-scale events in May 2015 and September 2015 and by assisting in the events' PE activities.

The interventions of PE2020 included the following steps (see Figure 1). The collection and analysis of feedback are reported separately in chapter three.

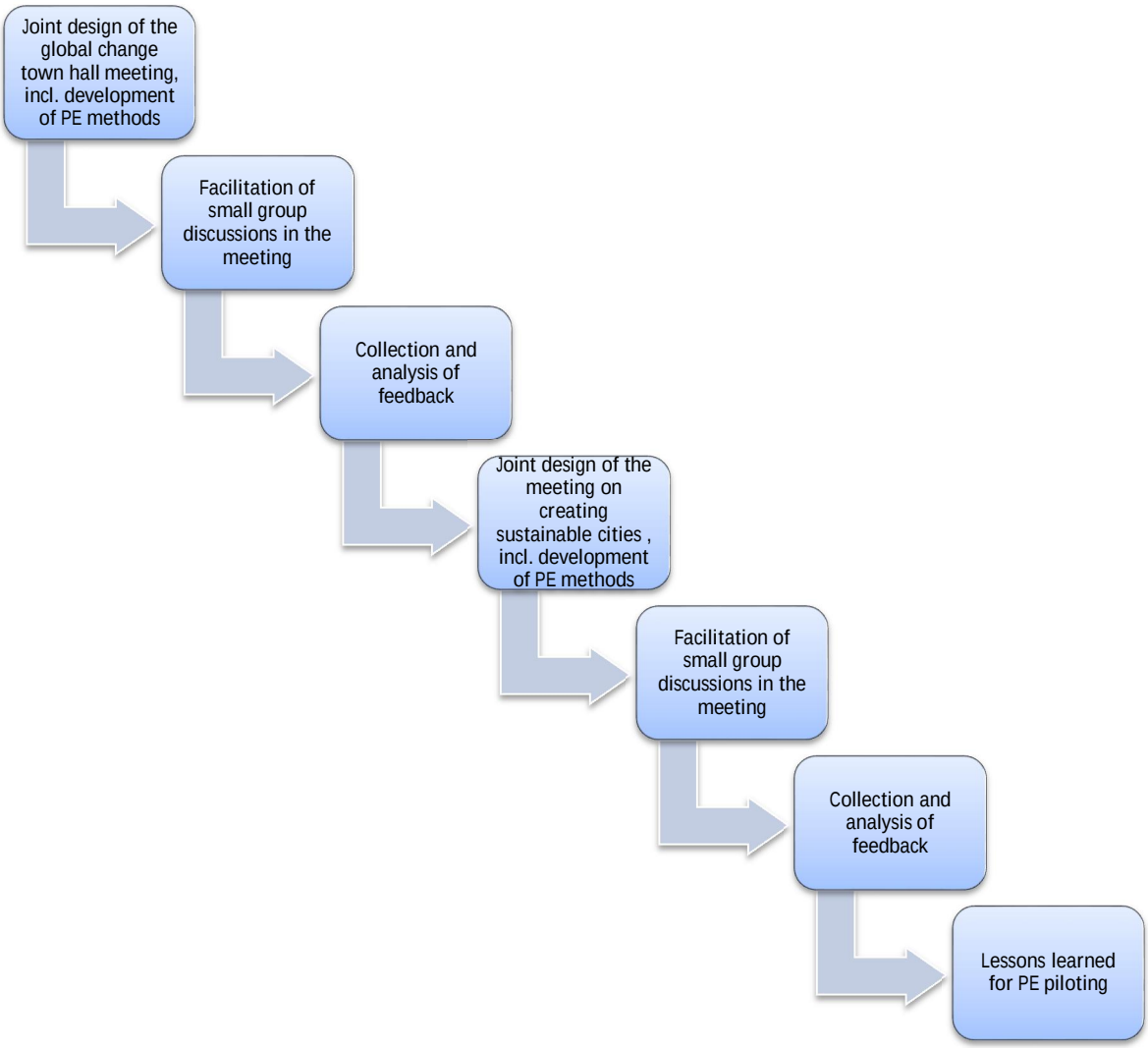

Figure 1. Phases of the pilot initiative.

2.4.1 Joint design of the global change town hall meeting

Between February and May 2015, PE2020 and Future Earth Finland had altogether four meetings which focused on the following topics:

- clarifying the key topics in the global change town hall meeting organised on the 26th of May, 2015 in Helsinki, Finland,
- brainstorming about the relevant groups that should be present in the town hall,
- disseminating information of the meeting to relevant groups,
- brainstorming about innovative engagement methods that could be applied in the event,
- further ideas about how to engage non-experts in the global change living lab.

Discussion on the topics of the town hall meeting centred around the need to narrow down the broad topic of global change research for the first town hall meeting. The solution was to use the eight key challenges identified at the strategic research agenda for Future Earth[3] as an agenda setter and to specify the priorities from the perspective of the Finnish society based on the key challenges in collaboration with the participants at the meeting.

The identified relevant groups that should be present in the town hall reflected the aims of the living lab which emphasised co-designing and co-producing research jointly with different stakeholder groups. However, there was also continuous discussion on the need to later widen the participating groups to involve also non-expert citizens in the living lab, such as city dwellers, families and school children. Also students and early career researchers were identified as a relevant group who should be present at the meeting because of their future agenda-setting role. For the first town hall meeting, students and early career researchers were contacted and encouraged to participate in the meeting. The responsibility of PE2020 was to disseminate information of the meeting especially to social scientists working in Finnish universities, and to students and doctoral students of both social sciences and natural sciences at the universities in the Helsinki region.

PE2020 also promoted the use of innovative engagement methods in the meeting. These innovative PE methods included joint design of *a pre-assignment* to give the participants a strong voice of the topics of the event already prior to the event, to receive input on key priorities in global change research in Finland, and to motivate them to attend the event. The participants were asked to answer four questions prepared by Future Earth Finland. The questions reflected the topic of the town hall:

1. By global change we refer to interlinked and large-scale environmental and societal changes. According to you, what are the most pressing challenges of global change affecting Finland?
2. The only extensive global change research initiative that has been funded by the Academy of Finland is FIGARE (1999–2002). What kind of global change research does Finland need and what are the best ways to organise and fund the research?
3. How would you define the conditions to do global change research in Finland? What kind of limitations do researchers face now if they are interested in global change research?
4. Where are the most important 'gatekeepers', phenomena/groups in key positions to enable/inhibit sustainable development in Finland?

[3] See the strategic research agenda for Future Earth (2014): http://www.futureearth.org/media/strategic-research-agenda-2014.

Altogether 37 participants completed the pre-assignment. The data was analysed by Future Earth Finland staff prior to the meeting and the key findings were summarised and handed out to the participants in the meeting.

PE2020 project conducted a network analysis of the key topics found in the pre-assignment exercise. The answers to the pre-assignments were visualised using software (TIB), which is available online at www.textisbeautiful.net. TIB makes use of statistical analysis, merges words into topics (cf. taxonomies or thesaurus) with a feature of expressing relationships between topics, and delivers a visual analysis of the narrative found in a text. This way the most important topics emerging related to global change could be found and presented to the participants of the workshop. The findings resulting from the network analysis were also a way to give an intuitive introduction to the topic of the day through the visualisation of the texts of the pre-assignments. The graphs in Figure 2 exemplify some of the visualisations distributed to the participants at the beginning of the meeting.

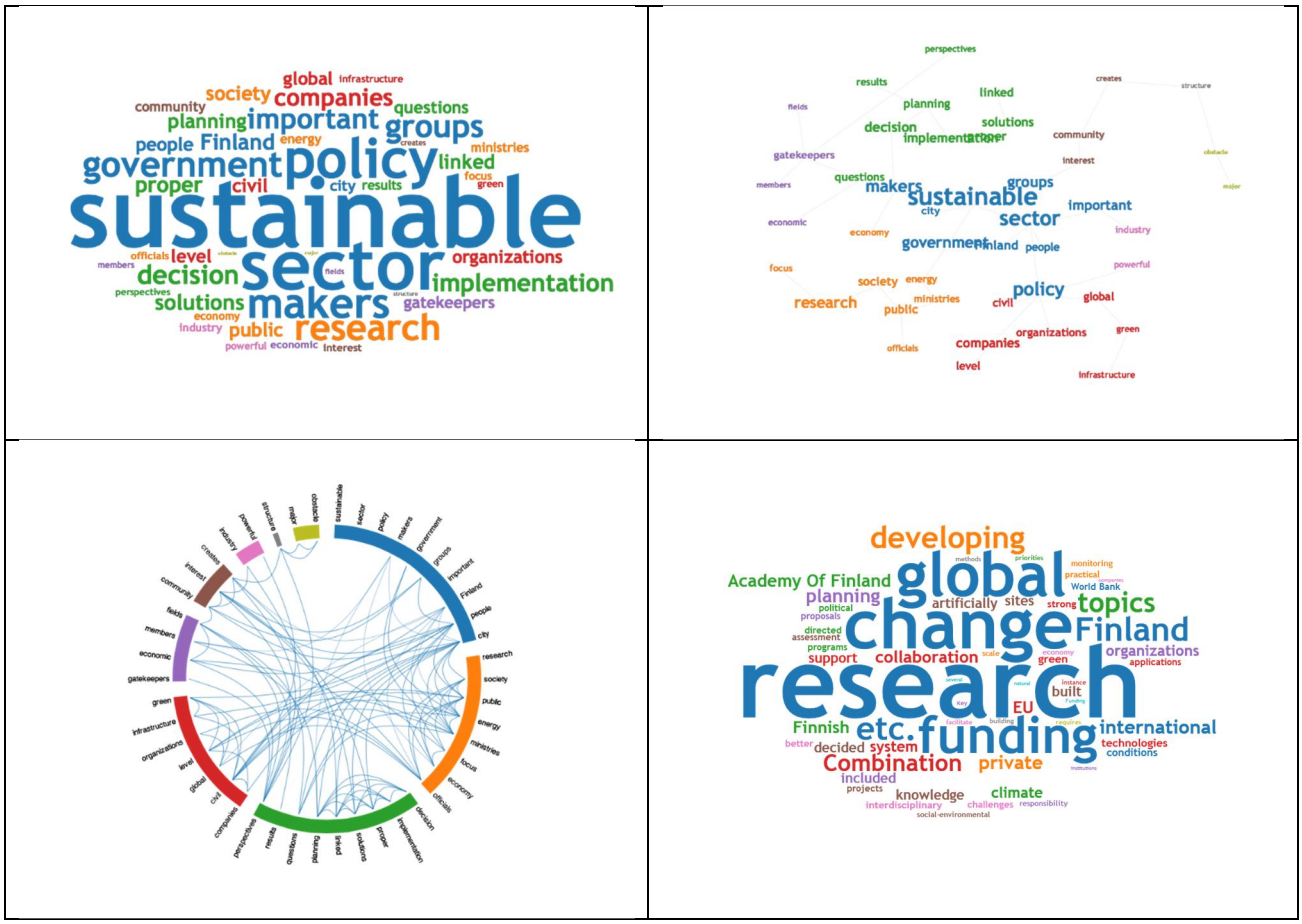

Figure 2. Some results of the network analysis of the preassignment as topic clouds.

Another method for stimulating discussion initiated by PE2020 was to utilise *small group discussions* as part of the town hall meeting. PE2020 was in charge of preparing detailed facilitator instructions for the small groups. The small group discussions took one hour in length.

Also *the infrastructure*, such as the physical arrangements at the venue, was planned in collaboration with PE2020 and Future Earth Finland to enable vivid interaction and dialogue. For example, rows of chairs were removed in the hall and replaced with small round tables that gathered the participants around them. Paper, sticky notes and further information of Future Earth were placed on the tables.

2.4.2 Facilitation of small group discussions in the town hall meeting

The 4.5-hour length global change town hall meeting was organised on the 26th of May, 2015 in Helsinki, Finland. The event took place in a local Europe hall, which is a public space intended to provide a discussion arena for European Union related issues.

The meeting gathered some 60 participants. Majority of the participants came from different Finnish universities (such as the University of Helsinki, the University of Turku, Lappeenranta University of Technology) and public research institutes (such as the Finnish Environment Institute, Geological Survey of Finland and Natural Resources Institute Finland). The researchers represented both natural sciences and social sciences (fields such as forest sciences, environmental sciences, physics, soil science, biology, geography, consumer economics, urban ecology, and environmental engineering). Other participants represented ministries (the ministries of employment and economy, foreign affairs, agriculture and forestry, and environment), non-governmental organisations, interest groups, companies, municipalities, and research funders. These together formed a heterogeneous and yet committed community of actors.

The role of PE2020 project in the meeting was to plan the structure and content of the small group discussion, and to contribute in facilitating the discussions. When entering the venue, the participants were directed to eight tables. The composition of the eight groups was planned so that each included at least one stakeholder representative (representing some other group than researchers) to ensure variety of perspectives and a need to justify one's arguments to actors with different backgrounds.

In the introductory round, the participants in each small group were encouraged to bring out their personal approach in the topic, revealing their most pressing interests and motivation for entering the dialogue. The one hour-length discussion had the same aim as the pre-assignment and the overall meeting. The main aim was to recognise the priorities in global change research from the perspective of Finland. In addition to recognising the themes, the participants deliberated which phenomena or which actors enable or inhibit sustainable development in Finland. After that, the participants discussed the present conditions of doing global change research in Finland and ideas about how these conditions should possibly be altered. The discussion ended with formulating one question to the panel discussion, which followed later in the programme. The language of the discussion was either English or Finnish depending on the composition of the group.

The eight groups each had a facilitator. The role of the facilitator was defined so that he/she would not take part in the discussion. He/she encouraged all the participants to take part in the conversation while asking everybody to keep their statements clear and concise. All participants were reminded of the importance of being respectful of divergent views. Instead of aiming at final conclusions, the facilitators pointed out that the aim was to launch the discussion.

All the facilitators took notes during the discussions. After the meeting, Future Earth Finland secretariat compiled the notes of the facilitators and key points from the pre-assignment into a summary report.[4]

[4] The summary 'Key challenges in global change research – discussion summary from the Future Earth town hall meeting on 26 May in Helsinki, Finland' can be found in the following website: http://futureearthfinland.fi/images/DISCUSSION_SUMMARY_5_06.pdf. See also the appendix 3.

2.4.3 Joint design of the meeting on sustainable cities

Building healthy, resilient and productive cities has been identified as one of the key focal challenges in the strategic research agenda of Future Earth. Also the participants at the global change town hall meeting in Helsinki identified the role of cities in tackling the challenges of global change as crucial. Many sustainability questions (such as those linked to housing, mobility, and consumption) are linked to cities and urban areas. Therefore, the second Living Lab meeting was agreed to focus on creating sustainable cities. The overall aim of the event was to collectively deliberate on ideas for potential joint projects on sustainable cities. This event had a special target of attracting some more participants from the private sector.

In August 2015, PE2020 and the secretary of Future Earth Finland held another meeting about the theme, public engagement methods and participatory groups of the meeting. PE2020 participated in the communication efforts by marketing the event to relevant audiences, such as researchers in urban studies and students in geography, ecology, and biology.

In deliberating on the innovative, interactive PE methods that could be utilised in the event, it was agreed again to have small group discussions, which received positive feedback in the earlier event in Helsinki. To spur yet more interaction among participants in the event, the researchers in the PE2020 project suggested using the Presemo tool[5]. Presemo is an online tool with which participants in an event can ask questions, comment and participate in voting. In this case, Presemo was used for voting among the priorities for most pressing challenges related to sustainable cities. Prior to the meeting, PE2020 organised a training session for all the facilitators on how to use the tool. Furthermore, a voting rehearsal, which all the facilitators took part in, preceded the event. The rehearsal aimed at identifying possible technical problems, timing issues and solutions for controversial voting outcomes (e.g., various alternatives receiving the same amount of votes).

2.4.4 Facilitation of small group discussions in the meeting on sustainable cities

The 4-hour length meeting on creating sustainable cities was organised on the 30th of September, 2015, in Tampere, Finland. The event took place in local premises at the centre of the city. The meeting gathered some 40 participants. Again the majority of the participants came from different Finnish universities and universities of applied sciences (such as the University of Helsinki, the University of Tampere, and Tampere University of Applied Sciences). The second largest participatory groups were from the private sector and municipalities. Participants also included representatives of research funders, public sector research institutes, non-governmental organisations and citizens.

The role of PE2020 in the meeting was to contribute in facilitating the small group discussions. When entering the venue, the participants were directed to five tables which each had a table moderator. In the group discussion, the participants were first trained how to use the Presemo tool with their electronic device. Second, the first part of the discussion concerned the topic of sustainable cities and identification of the most pressing challenges related to it. Each group discussed the challenges after which the moderators from each discussion group formulated three most important challenges for the whole audience to vote. Third, to make sure that the identified challenges were not overlapping, a jury composed of the members of Future Earth Finland's steering group and a PE2020 representative went through the challenges and lumped the overlapping challenges together. Fourth, the participants were asked to vote the three most

[5] Presemo has been developed by the Aalto University's Helsinki Institute for Information Technology HIIT and Aalto Start Up Screen.

significant challenges with their electronic device (such as laptop or mobile phone). As a result, five challenges with the most votes were selected for further elaboration. The top five challenges included:

- From fragmented planning to holistic perspective: a shared, sustainable city
- Decision-making in the city: co-production of ideas and information and transparent decision-making in long-term strategic planning
- Optimising sustainable growth and carbon-neutrality
- Sustainable and high-quality mobility; advancing public transportation, walking and cycling in the city
- Decentralised renewable energy, energy efficiency and sustainable energy management

The second part of the discussion aimed at identifying ideas for joint projects based on the five challenges. The participants could at this stage re-group according to their own interest. Each group with a moderator then worked on one joint project idea with lead questions for support. After discussing the project idea for 30 minutes, the moderators wrote down the project proposals in Presemo and presented the ideas with the opportunity of the group participants to add further information.

In the next phase, the proposals will be presented to the most important research funders in Finland related to global change and urban development, such as the Academy of Finland and Maj and Tor Nessling Foundation.

3 Impact of the pilot

PE2020 has systematically collected feedback both from the participants and the organisers of the two meetings in order to be able to evaluate the impact of the organised pilot initiative and to learn from the initiative to better implement future public engagement activities. After the first town hall meeting, PE2020 organised a feedback session with the Future Earth Finland's secretariat about the meeting and experiences of the overall collaboration with PE2020. This session aimed at evaluating the experiences gained so far, needs for improvements, and future plans. After the second meeting, feedback from the organisers was collected both face-to-face and in a written form. In addition, PE2020 collected feedback from the participants of the events.

3.1 Feedback from the organisers

The first town hall meeting was followed by a feedback session with the Future Earth Finland's secretariat. This session focused especially on the learning aspects of the national committee and the added value from collaborating with PE2020, such as PE2020's impact on the working methods in the town hall meeting. The feedback session also had the aim of seeking new ideas for collaboration for autumn 2015.

For the secretariat, the first town hall meeting had been a very positive experience. It succeeded in attracting a wide group of committed and enthusiastic participants and generating ideas for future events and activities of Future Earth Finland. The event was regarded as a successful kick-off event of the living lab. For the secretariat, the collaboration with the researchers of the PE2020 project in planning and organising the event had been 'tremendously important' and had impacted the whole nature of the event, especially the applied working methods.

According to the members of the secretariat, the small group discussions had been the most productive and fruitful part of the meeting, resulting in positive feedback from the participants. The small group discussion was able to maximise the input from the participants, who were all knowledgeable in the area of global change, but from different perspectives. The small groups were seen as an inspiring working method because they gave each participant a voice and also allowed everybody to interact with each other. The diversity of the groups reflected also the complexity and diversity of the theme of global change and emphasised the need for collaboration.

Overall, the arrangements in the town hall meeting worked well, because they were able to reach new type of interaction and dynamics between the participants. The conclusion was to include more participatory methods in the future events of the living lab. Acting as facilitator had been a new and fun experience for the members of the secretariat. Support given by the facilitator instructions and continuous discussions were seen as good and necessary.

After the second town hall meeting in Tampere, the organisers were again asked to give feedback. According to the organisers, also this event was successful. Related to the working methods, the Presemo tool was considered an exciting novelty which brought the event nice twist. However, the use of the online tool aroused also some stress as none of the organisers had previous experience using it. In planning schedules for future events, there were suggestions to reserve yet more time for small group discussions and for the general discussion at the end of meeting.

There had been some challenges in moderating the small group discussions, which in some cases proceeded at a rather general level. Also finding the right balance between participation and a need to make final decisions was regarded as necessary.

The organisers appreciated the PE2020 contribution in planning the small group discussions, including anticipation of potentially problematic situations and ethical dimensions, and collecting and analysing feedback from participants. The organisers also appreciated the PE2020 contribution in moderating the discussions. Overall, it was agreed that a careful preparation, training for moderators and clear moderator instructions are vital for the success of events.

In the feedback discussion, the organisers and PE2020 also deliberated on the possibilities of how to bring the bottom-up ideas gained at the event further: how they could possibly be utilised in decision-making especially at the local and regional level and in planning future calls for research funding in urbanisation.

3.2 Feedback from participants of the town hall meeting

After the first town hall meeting, a feedback form both in English and in Finnish was sent to all the registered participants via email. The form focused on the following aspects:

- overall satisfaction with the event,
- whether any new ideas or perspectives came out in the event concerning what kind of global change research is needed in Finland,
- whether all relevant perspectives of global change research were adequately covered during the event,
- learning aspects,
- feedback on the working methods,
- quality of the discussions,

- evaluation of one's own knowledge about the topic to be able to participate in the discussions, evaluation whether one was able to provide his/her own input about the links among environmental and societal changes,
- new interactive arenas or working methods that could be applied in the Living Lab.

Only seven respondents gave feedback through the form. Of these, six respondents were either very satisfied or satisfied with the content of the event. One respondent was neutral.

All the seven respondents felt that the event was able to come out with new ideas or perspectives related to global change research, especially emphasising the beneficial inter- and multidisciplinary approach of the event. According to the feedback, the respondents had learned more about the current adaptation discussion, the diversity of the global change phenomenon, needs for co-design approach, and the Future Earth Finland's activities. All respondents except for one who missed open-mindedness in his discussion group were satisfied with the working methods and quality of the discussions. The respondents also suggested new interactive arenas and working methods that could be applied in the living lab. These included webinars, online surveys, use of future studies methods (such as Delphi and scenario methods), and organising events in public spaces in the middle of a city that citizens cross by on a regular basis.

All respondents said they would attend Future Earth Finland's events in the future. Strongest personal motivation to attend future events were the inspiring atmosphere in the event, interest in the topics of global change and its importance, opportunity to get new ideas for one's future research, and the ideas of co-creation and co-design.

Furthermore, in the meeting, some participants spontaneously commented the working methods and arrangements. One commentator thanked the working language of the event (English) that enabled also non-Finns to participate. Some participants commented that the table arrangements created new kind of interaction between the participants when compared to traditional events. Furthermore, doctoral students appreciated the inclusiveness of the meeting and the focus group discussion in particular, because it gave each participant an equal chance to speak out and a chance to exchange arguments with researchers in different academic fields and with stakeholders.

3.3 Feedback from participants of the sustainable cities meeting

As the number of participants who gave feedback on the first event was low, this time feedback was collected manually at the end of the meeting in Tampere. As the language of the event was Finnish, also the form was in Finnish.

The form focused on the following aspects:

- overall satisfaction with the event,
- whether any new ideas or perspectives came out in the event concerning which or what kind of joint projects are needed in Finland related to the development of sustainable cities,
- whether all relevant perspectives of the lifecycle of sustainable cities were adequately covered during the event,
- what essentially new the event brought up,
- feedback on the working methods,
- quality of the discussions,

- evaluation whether one was able to provide his/her own input about the development of sustainable cities.

This time, 18 participants gave feedback of the event. Majority of respondents (14/17) were either satisfied or very satisfied with the content of the event.

All but one respondent stated that the event had brought up new ideas or perspectives concerning the need for joint projects related to the development of sustainable cities in Finland. About two-thirds of respondents stated all relevant perspectives of the lifecycle of sustainable cities were adequately covered during the event. Some new potential perspectives or topics were also identified. These included biodiversity, cities' relations to countryside and global networks, new modes of employment and economy in cities, waste management, ways to decrease carbon footprints in cities, the opportunities of recycling and reusing in urban planning, citizens' role in developing sustainable cities, new modes of participation, carbon neutrality, and how to support long-term strategic planning in cities.

Areas or topics the respondents identified as new in the event included, e.g., the multidisciplinary approach, alliances, new ways to implement planning projects, the creation and application of eco efficiency instrument in the Tampere region, the need to study decision-making, and citizens' involvement in planning and decision-making. All respondents stated that the working methods were suitable for the purpose of the event. Positive feedback was given about the working methods, e.g., good size and length of the small group discussions, the opportunity to focus on the most interesting topics through voting, Presemo tool, the use of moderators, use of different questions in support for the small group discussions, and balanced inclusion in the discussions. Ideas for further development concerned, e.g., possibilities for more general discussion about the bottom-up ideas, inclusion of all participants in the small group discussion, and the infrastructure in the event.

All respondents were satisfied with the quality of the discussions during the event. The majority of respondents stated they were able to provide their own input about the development of sustainable cities in the event. Again, majority of respondents responded they would attend Future Earth Finland's events in the future. Overall, the participants appreciated the interaction and the possibility to affect the project ideas.

3.4 Advantages

The large-scale events in Helsinki and in Tampere served as a starting point for long-term, continuing process that will further elaborate the phenomenon of global change and lead to collaborative research projects between different groups of actors. Thus, instead of focusing on individual events or project-based partnerships, the aim of the organisers of the pilot initiative is to create stable interaction relations and a long-term collaboration network between different actors to tackle the challenges related to sustainable development. This aim also serves the interests of the PE2020 project, which aspires to support a strong engagement culture in science community that does not see public engagement as an external activity but as a core part of research activities (Deliverable 1.2, 12).

Evaluating the long-term impact of the pilot initiative is at this stage difficult. However, some advantages can already be identified. These include:

- creating new mindsets and opportunities for participation and interaction in the field of global change research;

- allowing new networks and partnerships to be developed, creating new kind of knowledge-exchange between actors stemming from different backgrounds;
- developing opportunities for more inclusive meetings and discussions where each participant has an equal chance to speak out and a chance to exchange arguments between researchers in different academic fields, with stakeholders and citizens;
- building research-based and practical competence in stakeholder and citizen engagement (also including notions of the significance of participants' comfort, and feeling of inclusion and participation);
- providing peer support in an academic environment where co-design ideas are not always widely used or acknowledged.

3.5 Obstacles

Collaboration between Future Earth Finland and PE2020 worked well, and it was mutually beneficial, since it was an interest of both organisations to test with new type of 'upstream engagement' methods. At the same time, one of the identified obstacles was related to the open ended nature of the pilot co-design. Since the pilot project was not agreed before the PE2020 project started, there was a high uncertainty about the funding of activities by the side of Future Earth Finland. In one occasion, for example, a proposal for collaborative piloting of innovative PE processes was rejected by a Finnish funder, which to some extent delayed and limited original plans for collaboration. Luckily the programme found alternative funding to cover their part of activities. Overall, securing adequate, long-term funding conditions is a challenge to multi-actor living labs, which are not always recognised as a core activity at universities and research institutes.

Other observed obstacles were related to the nature of the town hall meeting as a deliberative process focusing on the agenda setting stage of the research policy cycle. As one participant in the Tampere town hall meeting stated after the event, it is difficult to create commitment by key researchers, funders and policy-makers to ensure that the results of deliberations will be implemented. – While this is a well-known challenge with most deliberative processes oriented at informing decision making rather than making decisions, the living lab concept is interesting, as it aims exactly at creating continuity and commitment among the key actors. So, there is the opportunity that what currently looks like a weakness of this PE concept will actually become a strength if activities can continue.

4 Grand Challenges addressed

Through the topics that emerged in the events, the pilot initiative is related especially to five societal challenges identified in the Horizon 2020 Framework Programme. These include the societal challenges on

- climate action, environment, resource efficiency, and raw materials,
- food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy,
- secure, clean and efficient energy,
- health, demographic change and wellbeing,
- smart, green, and integrated transport.

References

Deliverable 1.1 Inventory of PE mechanisms and initiatives, D.1.1. Public Engagement Innovations for Horizon 2020. Available at: www.PE2020.eu

Deliverable 1.2 Public Engagement Innovations – Catalogue of PE initiatives, D1.2. Public Engagement Innovations for Horizon 2020. Available at: www.PE2020.eu

von Hippel, E. 2005. Democratizing innovation. Cambridge, Massachusetts: The MIT Press.

Owen, R., P. Macnaghten & J. Stilgoe. 2012. Responsible research and innovation: From science in society to science for society, with society. Science and Public Policy 39 (6), 751–760.

Rogers-Hayden, T. & N. Pidgeon. 2007. Moving engagement "upstream"? Nanotechnologies and the Royal Society and Royal Academy of Engineering's inquiry. Public Understanding of Science, 16 (3), 345–364.

Schaffers, H. & Kulkki, S. 2007. Living labs: An open innovation concept fostering rural development. Tech Monitor, Sep-Oct 2007, 30–38.

Appendix 1. Feedback form on Future Earth town hall meeting, 26.5.2015, Helsinki

Thank you for participating in the Future Earth Town hall Meeting on 26 May, 2015!

In order to plan future activities, we would kindly ask you to spend a few minutes on giving feedback of the event and to share your ideas that would help the Future Earth Finland to organise coming events related to the Living Lab of Global Change Research.

OVERALL EVALUATION (PLEASE SELECT ONE OF THE ALTERNATIVES):

1. Overall, how satisfied were you with the content of the event? *very satisfied - satisfied - neutral - unsatisfied - very unsatisfied*

Please specify.

2. According to you, did any new ideas or perspectives come out concerning what kind of global change research is needed in Finland? *yes - no*

Please specify.

3. What did you learn from the event?

4. According to you, were all the relevant perspectives of global change research adequately covered during the event? *yes - no*

If you responded 'no', please indicate what perspectives you think were missing or neglected.

PLEASE RESPOND TO THE FOLLOWING CLAIMS:

5. The working methods (presentations, small group discussions, panel discussions) were suitable for the purpose of the event. *strongly agree - agree - don't know - disagree - strongly disagree*

Please specify.

6. I am satisfied with the quality of the discussions during the event. *strongly agree - agree - don't know - disagree - strongly disagree*

7. My own knowledge about the topic of global change was sufficient to participate in the discussions. *strongly agree - agree - don't know - disagree - strongly disagree*

8. In the meeting, I was able to provide my own input about the links among environmental and societal changes. *strongly agree - agree - don't know - disagree - strongly disagree*

BECAUSE OUR AIM IS TO MAKE GOOD USE OF THE PARTICIPANTS' EXPERIENCES AND IDEAS, WE WOULD ASK YOU TO KINDLY PROVIDE A LIST OF SUGGESTIONS FOR OUR FUTURE EVENTS:

9. Please suggest new kinds of interactive arenas or working methods that could be applied in the Global Change Living Lab in Finland.

10. Would you attend Future Earth Finland's events in the future? *yes - no*

If you responded 'no', please indicate why not.

If you responded 'yes', please indicate what is your strongest personal reason for participation.

INFORMATION ON THE RESPONDENT:

Gender *female - male*

Age *≤22 - 23–27 - 28–32 - 33–37 - 38–42 - 43–47 - 48–52 - 53–57 - 58–62 - 63–67 - ≥68*

Type of institution/organisation

university - public research organisation – ministry - company - non-governmental organisation - interest group - other

If applicable, what is your academic discipline?

How did you hear about the event?

through an email list - Facebook - Twitter - from a colleague - other

Any other comments or greetings?

Appendix 2. Feedback on the life cycle of sustainable cities meeting, 30.9.2015, Tampere [original in Finnish; translated by PE2020]

1. How satisfied were you with the content of the event? (PLEASE SELECT ONE ALTERNATIVE)

very satisfied - satisfied - neutral - unsatisfied - very unsatisfied

2. According to you, did the event bring up any new ideas or perspectives concerning which or what kind of joint projects would be needed in Finland related to the development of sustainable cities? *yes - no*

3. According to you, were all the relevant perspectives of the lifecycle of sustainable cities adequately covered during the event? *yes - no*

> If you responded 'no', please indicate what perspectives you think were missing or neglected.

4. What essentially new did the event bring up?

5. Would you attend Future Earth Finland's events in the future? *yes - no*

PLEASE RESPOND TO THE FOLLOWING CLAIMS:

6. The working methods were suitable for the purpose of the event. *strongly agree - agree - don't know - disagree - strongly disagree*

> 6a. In which ways did the working methods support the discussion? What could have been done otherwise?

7. I am satisfied with the quality of the discussions during the event. *strongly agree - agree - don't know - disagree - strongly disagree*

8. In the event, I was able to provide my own input about the development of sustainable cities. *strongly agree - agree - don't know - disagree - strongly disagree*

INFORMATION ON THE RESPONDENT:

Gender female - male

Type of background organisation *university - company - public research organisation - ministry - non-governmental organisation - something else, please specify*

How did you hear about the event? *through an email list - Facebook - Twitter - from a colleague - the website of the City of Tampere - somewhere else, please specify*

Any other comments or greetings?

Appendix 3. Results of the first town hall meeting

The summary of the results on research priorities related to global change, 'Key challenges in global change research – discussion summary from the Future Earth townhall meeting on 26 May in Helsinki, Finland', can also be found here. A summary of the second meeting in Tampere can be found here.

KEY CHALLENGES IN GLOBAL CHANGE RESEARCH

Discussion Summary from the Future Earth Townhall Meeting on 26 May in Helsinki, Finland

The Future Earth Townhall meeting gathered over 60 participants to discuss global change research priorities in Finland. The participants represented different fields of science from universities and research institutes and stakeholders from ministries, private companies, and interest group organizations and NGOs. This document summarizes the key points from the pre-assignment questions and from discussions during the event.

The event was supported by University of Helsinki (Department of Physics, Division of Atmospheric Sciences), Maj and Tor Nessling Foundation, Council of Finnish Academies, and PE2020 Public Engagement Innovations for Horizon 2020.

The event was organized by: FUTURE EARTH FINLAND
National Committee for Global Change Research
www.futureearthfinland.fi, @FESuomi

Key points at one glance

Integrated approach to interlinked challenges: Understanding the big picture of global challenges is of utmost importance. Global environmental and societal challenges are systemic and interlinked and should be approached from an integrated perspective. Global-local dynamics are also a key aspect since local actions have global consequences and vice versa.

Finland should be positioned in a global context: The global change challenges we face are global in nature and their effects in different parts of the world can be unpredictable. Thinking about the challenges solely from a Finnish perspective is not fruitful in the long run. In addition to national interests, we should embrace global responsibility: part of Finnish research efforts should be allocated where problems are the most pressing, often outside our own borders.

Topical global change challenges from Finnish perspective: Baltic Sea, sustainable energy policy and urban-rural dynamics: Future conditions of the Baltic Sea (e.g. storms, coastal erosion, future ice-free Baltic Sea, phosphorus cycle) and the challenge to find economically viable solutions for its management will affect Finland in many ways. Finland is also lagging behind in the transition towards renewable energy sources. Finland's target to become carbon neutral by 2050 requires substantial changes to energy policy and to production and transfer systems. This is linked to the strong urbanization that is changing Finnish lifestyles, work, and mobility, and a pressing question is whether to develop the urban way of life further or take steps to keep the whole country populated. Finally, other challenges recognized were related to the Arctic, sustainable consumption, aging societies, and transforming the aging Finnish society into one more sympathetic toward global immigration.

"Gatekeepers" of sustainable development in Finland: Civil society, scientific community, governance, regional actors, private sector, and media are among the most important 'gatekeepers' of global change adaptation/mitigation: phenomena or groups in key positions to enable or inhibit sustainable development in Finland. In particular, many sustainability questions are linked to cities.

How to manage complexity? Understanding the phenomenon of global change as a whole should always be the starting point. Although scientific excellence in different fields lays the basis for interdisciplinary understanding, too deep a specialisation can lead to problems when people from different disciplines and from different backgrounds cannot properly communicate with each other and do not have sufficient incentives to do so.

From understanding to solutions: Research should be co-designed with the stakeholders of scientific knowledge. Involvement of private, public and civic sectors from all levels (local, regional and national) is crucial in order to ensure maximum societal impact. However, scientists need support and guidance in co-design methods from fields that already have more experience. Moreover, effective research co-design requires more understanding and training on participatory methods.

Funding directs and supports global change research: Global change research requires a new, long-term funding strategy and a strong institutional setting. We need both funding for basic research and novel risky ideas as well as funding for strategic (government-driven) research. National funding programs should collaborate and frame research questions and funding programs together to support international global change research following the example of, for instance, JPIs and ERA-NETs. In Finland, the biggest research councils and private foundations should look for opportunities to collaborate. Collaboration with business and industry is also an important way to seek for new ways of funding global change research.

Community for global change researchers and stakeholders. Developing a grass-root community of global change researchers and users of research for sharing ideas, insights, and results is crucial. Joint platforms for information and data sharing would be a great step forward.

DISCUSSION SUMMARY

Future Earth's eight key challenges from the point of view of Finland.

Integrated approach to interlinked challenges

The participants discussed key research priorities based on the eight challenges identified in the Future Earth strategic research agenda and emphasised the importance of understanding the big picture of global challenges. Global environmental and societal challenges are systemic and interlinked and, therefore, these challenges should be approached from an integrated perspective.

Global-local dynamics form an important aspect of global change. Local actions have global consequences and vice versa; although global cooperation is necessary to tackle the challenges, many if not most solutions remain local. Also, solutions to global problems are interlinked: addressing problems such as the food-water-energy nexus, for example, requires cooperation among different ministries and research institutes.

Finland should be positioned in a global context

The global change challenges we face are global in nature and their effects in different parts of the world can be unpredictable. Consequently, the participants emphasized that we should think long-term and keep a broad focus when thinking about global change research. For example, the development in Russia affects Finland in many ways. Similarly, problems in Africa may not be relevant for Finland at the moment but they may become so in a decade. Therefore, thinking about the challenges solely from a Finnish perspective is difficult. Instead of a national perspective, the participants favoured a regional point of view where the Nordic countries would form a relatively uniform unit. Many of the issues Finland deals with are similar in other Nordic countries. Moreover, the participants pointed out that in contrast to national interests, we should embrace global responsibility: Finnish research efforts should be allocated where problems are the most pressing: not necessarily in Finland.

Sustainable energy policy and urban-rural dynamics

Out of the eight Future Earth key challenges, the following emerged as critical from the Finnish perspective:

Challenge 3 "Safeguarding land, freshwater and marine natural assets" was considered very important. Future conditions of the Baltic Sea (e.g. storms, coastal erosion, future ice-free Baltic Sea, phosphorus cycle) and the challenge to find economically viable solutions for its management will affect Finland in many ways. Moreover, the participants were worried about the ability of the Finnish nature - crops, forests and wetlands, flora and fauna - to adapt to changing weather conditions in the future.

Great importance was assigned also to challenges 1 **"Delivering water, energy, and food for all"**, 2 **"Decoupling carbon emissions from economic growth"**, and 5 **"Promoting sustainable rural futures"**. Compared to Germany and the Netherlands, Finland is lagging behind in the transition towards renewable energy sources. Finland's target to become carbon neutral by 2050 requires substantial changes to energy policy and to production and transfer systems. We need more transparent energy policy, a decrease in energy consumption and a faster transition from fossils/nuclear to renewables. In terms of renewables, Finland is currently investing heavily on forest economy. The "all-for-forest-based-bioenergy" strategy may lead to overspecialized sustainability and that other sources of renewable energy should be considered as well.

Finland, like many other countries, is undergoing strong urbanization. A pressing question is whether to develop the urban way of life further or take steps to keep the whole country populated. Urbanization poses particular challenges. Many sustainability decisions (such as housing, mobility, eating) are linked to cities. Questions of health and well-being are crucial in cities, and developing lively and attractive cities that would curb social segregation is important. However, alongside sustainable urbanization we should endorse regional equality against emptying rural areas. Rural areas are important sources of natural resources and other ecosystem services such as food. As a matter of fact, food production may even become easier in Finland in the future with climate change. The participants pointed out that although sustainable global trade and production needs to be planned and developed, there are still reasons to maintain domestic agriculture and food production.

Other challenges recognized were related to sustainable consumption, aging societies, and transforming the aging Finnish society into one more sympathetic toward global immigration. Extremely fast warming of the arctic areas and the related moving of flora and fauna towards higher latitudes and the influx of harmful alien species form also an important challenge for Finland.

The most important "gatekeepers" of sustainable development in Finland

The participants discussed the most important 'gatekeepers' of global change adaptation/mitigation: phenomena or groups in key positions to enable or inhibit sustainable development in Finland. The following groups and categories were identified:

CIVIL SOCIETY. NGOs and citizens can make a change by engaging in public discussion. In this respect, MEDIA is also an important gatekeeper since politicians react to what it highlights. In addition, citizens are powerful agents as consumers. Therefore, tackling questions of global change requires changing citizens' prevalent attitudes and lifestyles. NGOs as well as the EDUCATION SYSTEM (schools, higher education) have a crucial role in raising awareness of sustainable living.

SCIENTIFIC COMMUNITY. Scientists, intellectuals, and inventors with their communities such as research institutes and research councils have an important role in providing scientific findings and in communicating them to society and decision-makers. However, researchers are often very cautious in their arguments and recommendations: they emphasise uncertainties whereas policy-makers often demand clear, one-dimensional policy solutions quickly. This makes the dialogue difficult. Nevertheless, researchers should be encouraged to communicate openly especially about potential risks in a certain policy area. Another challenge identified was a certain partiality of research funding: too much funding is directed to already familiar topics and well-known researchers. The scientific community should be more innovative, inclusive and multidisciplinary to better respond to the challenges.

GOVERNANCE. Politicians, high-level civil servants and policy-makers (especially the Ministries for Employment and Economy and of Agriculture) are powerful gatekeepers. Civil servants are in an important in-

termediary position because they often have to interpret scientific results to decision-makers.

REGIONAL ACTORS. City councils and planners, residents, and regional Centres for Economic Development, Transport and the Environment (ELY centres) have an important role. Local perspectives are crucial: small communities contribute to global change and are affected by it. Small communities are also more agile to adapt to change. In fact, staff in municipalities can be more knowledgeable on sustainable development than state-level decision makers, and residents can be more eager to change their habits because they want to care for the future community.

PRIVATE SECTOR: Global industry and companies (forest sector, chemical and food industry, the cleantech cluster, building, real estate and energy production companies), interest groups (especially farmers), think tanks were also recognized as gatekeepers. Some of the participants anticipated problems when collaborating with industry. For example, some companies may prefer to secure data and to focus on short-term economic benefits. In contrast, some participants pointed out that the biggest companies can act as forerunners and small companies will follow them. In particular, their role in the reduction of CO_2 emissions is effective. In this respect, a key question is how to take advantage and use 'big money' that is available from environmentally active companies that are currently investing in 'risk fields'.

More generally, the participants discussed the key challenges in moving towards evidence-based decision-making and sustainable economic development. The democratic system was seen problematic because of its heterogeneous and often very short time frames. The business sector has its focus on annual quarters, the political sector focuses on the 4-year terms between elections and so on. What should be the time scale of decision-making on global change and who has the overall responsibility for it? How could we create and enforce this kind of responsibility?

The participants emphasized that both the public sector and companies are in a situation where values challenge knowledge as basis for decision-making. Decision-making in the public sector is hectic and a large amount of research results may be confusing. Companies, too, need scientific knowledge to support their business.

Global change research: characteristics and support mechanisms from the Finnish perspective

The participants discussed what kind of global change research Finland needs and what structures and funding strategies could best support it. The participants supported the two underlying principles in the Future Earth research approach: interdisciplinary research and collaboration with various stakeholders in society. They emphasized that solutions-oriented global change research requires an integrated approach: collaboration among natural and social sciences, humanities and engineering, and continuous and active interaction with the surrounding society. In order to achieve this new type of transdisciplinary research culture, we need new ways of designing, conducting, and funding research.

How to manage complexity?

The participants emphasised the importance of studying and understanding the phenomenon of global change as a whole: global challenges are interlinked and "everything affects everything else". Consequently, the question is how to achieve understanding on the various linkages and how to manage the complexity they form.

Global change research clearly requires strong collaboration between natural and social sciences to reveal the connections between the different challenges. Humanities and engineering sciences are important as well. Global change research, however, is not well distinguished from other fields of science, such as futures studies, environmental sciences, climate sciences, and sociology. The participants pondered whether global change research is already mature enough to be its own field of science and what would be the right balance between different sciences, particularly between natural and social sciences. Global change research should focus also on socio-cultural and techno-economic factors in addition to natural ones.

One major limitation in performing global change research is the current tendency to acquire profound expertise in a particular field of science which often leads to a lack of an interdisciplinary perspective. Although scientific excellence in different fields lays the basis for interdisciplinary understanding, too deep a specialisation can lead to problems when people from different disciplines and from different backgrounds cannot properly communicate with each other and do not have sufficient incentives to do so. One way to enhance collaboration and shift towards true transdisciplinarity is through education. Adding transdisciplinary elements to bachelor and master training could help. In addition, doctoral students and early career researchers were recognized as groups that could comparatively easily adopt more transdisciplinary thinking.

From understanding to solutions

Interdisciplinarity can also go too far: looking at too much complexity may take us too far away from practice. Therefore, in addition to understanding the challenges, efforts should be made to provide actual solutions to global problems. The participants suggested that a sufficient part of global change research should be directed to transition studies. Another key aspect was that research should be co-designed with the stakeholders of scientific knowledge. Involvement of private, public and civic sectors from all levels (local, regional and national) is crucial in order to ensure maximum societal impact. For example, engineers must speak with building companies and scientists must get to the field and communicate with decision-makers and civil servants. Although co-design has been practiced for decades in certain fields of science, it is relatively new to natural scientists. Therefore, scientists need support and guidance in co-design from fields that already have more experience. Moreover, effective research co-design requires more understanding and training on participatory methods.

In order to support more efficient dissemination of scientific information and evidence-based decision-making, scientists should get encouragement and training in lobbying and in other modes of societal interaction. The participants recommended that scientific panels such as

the national climate panel, the national panel for sustainable development, and Future Earth national committees should be used as resource in science-policy interface.

Funding guides and supports global change research

Funding was identified as a crucial question on the way to transdisciplinary global change research. Global change research was considered more expensive than traditional research as it requires a transdisciplinary approach and diverse expertise. Global change research requires a new, long-term funding strategy and a strong institutional setting. In contrast, climate change research has managed to establish itself as a strong discipline with several funding structures, and participants suggested that global change research needs similar powerful structures.

Currently, a large part of the funding is national. The problem is how to fund international global change research when the majority of available funding is national? The participants suggested that national funding programs should collaborate and frame research questions and funding programs together to support international global change research following the example of, for instance, JPIs and ERA-NETs. On the one hand, coordinating the existing funding mechanisms more efficiently is important; on the other hand, establishing new joint programs is also necessary. In Finland, the biggest research councils and private foundations such the Academy of Finland, TEKES, the Strategic Research Council and Maj and Tor Nessling Foundation could look for opportunities to collaborate. On the EU and global level, EU, OECD, World Bank etc. should join their forces in the spirit of Joint Programming Initiatives. Collaboration with business and industry was also considered an important way to seek for new ways of funding global change research.

The participants discussed the importance of finding the right balance between basic and strategic research funding in Finland, Europe, and internationally. We need both funding for basic research and novel risky ideas as well as funding for strategic (government-driven) research.

In Finland, two new funding mechanisms for strategic research were launched in 2014 (short-term funding under the Prime Minister's office and longer six-year funding under the Strategic Research Council to solve urgent and wicked problems affecting Finland). These new funding instruments were seen as good and beneficial as long as this money is not taken too heavily away from basic research. One participant was bewildered by the need to have more research to support decision-making, since the public research organisations should already have this role in Finland. Some participants pointed out that also ministries should have more money to fund 'real research' (instead of funding only policy reports, etc.).

Community for global change researchers and stakeholders

Finland has high-level expertise on the issues related global change, but research groups are small and scattered. Another problem is that scientists lack platforms for meeting and discussing their research with stakeholders. The participants supported an idea of a community for global change researchers and users of research where they could share ideas, insights, and results and support each other. In addition, joint platforms such as archives or databases for information sharing would be useful.