More of the same or something different? : Arguing for disruptive public engagement in research and innovation policy

Matschoss, Kaisa Johanna

Public Participation in Developing a Common Framework for Assessment and Management of Sustainable Innovation, CASI

2017

CASI: Public Participation in Developing a Common Framework
for Assessment and Management of Sustainable Innovation

CASI

REACHING OUT FOR SUSTAINABLE INNOVATION

Deliverable 7.3., Task 7.3

Organisation responsible for the deliverable
META Group

Editors:
Anita Tregner-Mlinaric

2017

Dissemination level: **Public**

CASI: Public Participation in Developing a Common Framework
for Assessment and Management of Sustainable Innovation

THEME SiS.2013.1.2-1
Mobilisation and Mutual Learning (MML) Action Plans: Mainstreaming Science in Society Actions in Research

CASI

Grant Agreement no. 612113

REACHING OUT FOR SUSTAINABLE INNOVATION

Deliverable **7.3**, Task **7.3**

Organisation responsible for the deliverable
META Group

Editors:
Anita Tregner-Mlinaric

Date of delivery
2017

Project start date:	*Duration:*	*Coordinating organisation:*
January 2014	*42 months*	*ARC Fund - Applied Research and Communications Fund, Bulgaria*

Dissemination level: **Public**

Table of revisions

Version number	Name of partner last involved	Date of last update
1.1	Anita Tregner-Mlinaric, Petteri Repo	April 2017
1.2	Anita Tregner-Mlinaric, Petteri Repo	May 2017
1.3	Anita Tregner-Mlinaric, Petteri Repo	June 2017
1.4	Anita Tregner-Mlinaric, Monika Popper	July 2017
1.5	Marko Hajdinjak	August 2017
1.6	Anita Tregner-Mlinaric	September 2017
1.7	Ventseslav Kozarev, Marko Hajdinjak	September 2017
1.8	Anita Tregner-Mlinaric	October 2017
1.9	Ventseslav Kozarev	October 2017

Disclaimer

The information in this document is provided as is and no guarantee or warranty is given that the information is fit for any particular purpose. The user thereof uses the information at his/her sole risk and liability. Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use that might be made of the following information.

Contents

Contributors

Catarina **AZEVEDO**, Inova +

Fernanda P**INTO AMORIM**, Câmara Municipal de Espinho

Kaisa **MATSCHOSS**, University of Helsinki

Kamila **DOBEK**, Poznan Science and Technology Park

Malgorzata **PIOTROWICZ**, Poznan Science and Technology Park

Maria **ALEXANDROVA**, Cleantech Bulgaria

Marko **HAJDINJAK**, ARC Fund

Marta **PINTO**, Inova +

Mattia **MARTINI**, University of Milano-Bicocca

Monika **POPPER**, Futures Diamond

Nedka **GATEVA**, Technologica

Petteri **REPO**, University of Helsinki

Sarah **VAN EYNDE**, Katholieke Universiteit Leuven

Ventseslav **KOZAREV**, ARC Fund

Vincente **PINTO**, Câmara Municipal de Espinho

Executive summary

Anita Tregner-Mlinaric, META Group

The Europe 2020 Strategy set the course of Europe towards smarter and greener economy, with its prosperity and future built on the cornerstones of research and innovation. In 2007, within the 7th Framework Programme for Research and Technological Development (FP7), "Science and Society" became "Science in Society (SiS)," with its agenda set towards developing a framework for Responsible Research and Innovation (RRI) focused on the engagement of societal actors via inclusive participatory approaches. CASI project corresponds to this framework and focus, hence the objective of this final report is to provide policy recommendations based upon the work developed during the lifetime of the project and its results translated in the actionable strategies driven by public participation and mobilisation, and mutual learning approach.

In lieu of Brexit and political, economic and stability turmoil that is challenging the European Member States in finding ways how to address them, accompanied with the raising voice of populism questioning the integrity and future of the European Union, the ongoing concern is how to address societal challenges and what needs to change in the current approach and thinking. As a response to the latter, the European policymakers are putting a stronger focus on public engagement and involvement of broader range of stakeholders in a sustained dialogue among all engaged actors. The same applies to research and innovation processes, whereas the standpoint of the European Commission is that research and innovation must respond to the needs and ambitions of society, reflect its values, and be responsible.

Over 42 months, starting in January 2014, CASI project has been working on Developing a Common Framework for Assessment and Management of Sustainable Innovation based on a principle of Public Participation as a response to one of the Societal Challenges set out in the H2020 programme of the European Union, namely "Climate action, environment, resource efficiency and raw materials." CASI represents an EU-wide cross-sectoral partnership on innovation-related challenges, considering not only the impacts of social and technological innovation, but also the types of actors involved and their inherent interests. It thus effectively integrates the perspectives of civil society, SMEs, industry, policy stakeholders, and leading academics. This collaboration investigates the scope of sustainable innovation as a societal phenomenon and enables the elaboration of an assessment framework of sustainable innovation practices, whose application can be successfully integrated into public policy developments.

During this journey and now at its very end, the project endorses results, which are the outcome of very complex and intense activities and of the interactive exchange of experience and knowledge among the above noted groups of stakeholders, with an outreach to 28 European Member States. *Therefore, this report translates CASI experiences and results into actionable strategies that strive for impacts in sustainable innovation and public participation in it. The latter has been underlined as one of the cornerstones in the European Commission's vision of the future of European research, science and innovation.*

The 3rd CASI Annual Policy Report is the last project publication providing specific policy recommendations based on the project activities and input. The 1st CASI Annual Policy Report positioned the CASI project in a wider sustainable innovation policy context of Societal Challenge 5 (Damianova *et al.*, 2015). The 2nd Policy Report focused on CASI-F, the framework developed during the CASI project and aimed towards assessing and managing sustainable innovation. The report addressed the necessity of obtaining a critical perspective that can challenge the consistency and usefulness of CASI-F and proposed a set of messages that could drive policy action in the short term towards more efficient sustainable innovation-oriented governance (Popper and Velasco, 2017). Both reports, together with the policy briefs and the policy blogs, present an integral part of CASI policy monitoring, the so-called CASI Policy Watch, which was executed via regular online publishing on CASI website. The policy briefs focused on strategic priorities and relevant policies addressing the H2020 grand challenge "Climate action, environment, resource efficiency and raw materials (SC5)" with a focus at innovation. The policy briefs were divided into two categories: the European level policy briefs that monitored the relevant policy developments at EU level;

and national level policy briefs, which addressed the EU topics within the context of the national and/or regional perspective. This approach enabled the collection of important policy insights of wider outreach and showcased the level of impact of EU policy-making at Member States' level, its implementation scope, as well as gaps and necessary steps to overcome them. Awareness building about sustainable innovation trends, policy developments, project related activities, findings and insights was further communicated via the CASI online policy blog, which was successful in reaching out to target audience and contributed to building of broad community of CASI followers. The CASI Policy Watch methodology and approach have resulted in the publishing of 14 EU level and 115 national level policy briefs, 3 annual reports and numerous contributions to the online policy blog with over 155,000 views.

Objectives and structure of this report
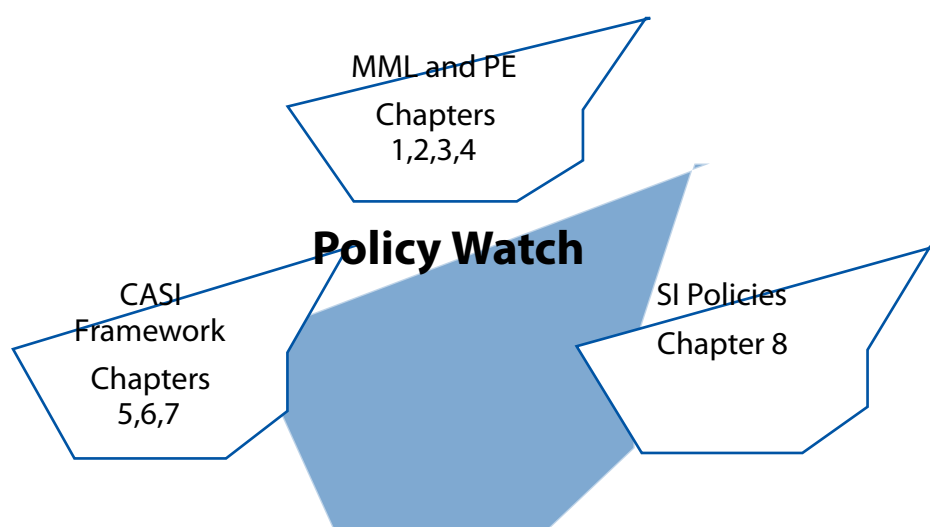
Figure 1: Overview of the structure of the report

This report comprises eight chapters grouped in three sections: *Mobilisation and Mutual Learning (MML) and Public Engagement* (the first four chapters)*, Applications of the CASI Framework (CASI-F)* (chapters 5, 6 and 7)*, and concludes with Sustainable Innovation Policies* (chapter 8). Following are brief summaries of the report's contents:

Chapter 1, titled "Application of CASI MML methodology to policy formulation", presents the potential application of a public participation approach to policy design at local and regional levels following the CASI Mobilisation and Mutual Learning (MML) methodology. The chapter argues that wider public engagement creates opportunities to enrich the process of designing public policies in different areas (environmental, economic development, competitiveness etc.) at different levels (local to global, generic and sectoral), compared to "traditional" policy-making. *Furthermore, this chapter focuses on possibilities to apply the CASI experience with "citizens-experts-citizens" process on policy design at local and regional level including INTERREG EUROPE programme*.

Chapter 2, titled "How to reach stakeholder involvement in collaborative settings? Evidence from country-based networks in CASI", focuses on the concept of stakeholder involvement and public engagement (PE), and its central role in the discourse of research process and decision-making activities, which becomes even more crucial when the aims of these initiatives regard sustainability and sustainable innovation issues. The chapter presents main findings of the study conducted in lieu of the empirical context represented by the country-based networks of stakeholders managed by the CASI partners during the lifetime of the project. The aim of these networks was to involve and engage different actors in the development of a common framework for the assessment and management of sustainable innovation. *The results of this study can inform all institutions involved in MML projects and public engagement initiatives, providing specific guidelines to be more effective in reaching their objectives.*

Chapter 3, titled "Transdisciplinarity in sustainable innovation research: Networks of mutual learning", focuses on networks that may emerge because of Mobilisation and Mutual Learning Action Plans (MMLAP's) and discusses to what extent these networks reflect the transdisciplinary nature of research on so-called wicked problems. By visualising the networks of societal stakeholders and citizens that were engaged during the four activities organised in the CASI project by three of the partners, the chapter demonstrates that transdisciplinary networks on sustainable innovation span boundaries between different societal stakeholders of which some hold key structural positions in the networks that affect mutual learning. *The conclusion reflects on the implications of transdisciplinary network structures for mutual learning.*

Chapter 4, titled "More of the same or something different? – Arguing for disruptive public engagement in research and innovation policy", argues that citizens provide opportunities for disruption in the development of research and innovation priorities based on an engagement process executed in the context of the CASI project. The project provided 245 citizens in 12 European countries the possibility to express their visions on sustainable futures, which were then elaborated as research and innovation priorities by 22 experts. The results of this process indicate that giving voice to citizens produces different kinds of ideas than listening to experts only, *which highlights an argument that if the aim is to gain novel and potentially disruptive ideas, turn to the citizens.*

Chapter 5, titled "CASI pilot implementations – an insight from Bulgarian innovative companies", analyses the feedback provided by a specific type of stakeholders involved in the management of sustainable innovations – the business stakeholders from Bulgaria, who participated in the CASI pilot implementation and developed a Business Action Roadmap. In addition, representatives of Bulgarian start-ups have implemented the tasks foreseen in their Action Roadmap as participants in the Climate-KIC Bulgarian acceleration programme. *Thanks to CASI-F methodology, the Bulgarian innovators, as presented in this chapter, plan further actions based on intensive cooperation with other business representatives and societal groups to influence governance.*

Chapter 6, titled "CASI results as a toolkit for its end-users with a focus at the regional perspective: CASI and Co-working spaces", looks at CASI results from a perspective of a virtual co-working space available to a wide range of stakeholders. More specifically, the chapter argues *that CASI framework (CASI-F) and supporting online tools can be considered as a living 'knowledge co-creation, co-assessment and co-management tool' aiming to explore the impact of sustainable innovation on the economic, social, environmental, governance and infrastructure systems transformation.*

Chapter 7, titled "Sustainable Innovation in education for Sustainable Development", presents sustainable innovation initiatives that were mapped and analysed in the CASI Project, and which share common features and approaches in addressing the new learning experiences. *It also illustrates how the need for a new vision of education and learning environments in the research priorities is explored and rated during the citizens-experts-citizens workshops carried out in 12 EU countries.*

Chapter 8, titled "Sustainable innovation policy, focus on issues alongside challenges", reviews whether policies for sustainable innovation should be developed according to four definitions of SC5. To this aim, it carries out topic modelling of recommendations evident in CASI policy briefs, which have been published in 28 European countries. *The chapter argues that it would be worthwhile to consider a diversity of issues alongside pre-defined challenges when developing policies for sustainable innovation.*

References

Damianova, Z. *et al.* (eds). (2015). *CASI in the Wider Policy Context.* First CASI Annual Policy Report. http://www.casi2020.eu/app/web1/files/download/casi-d7-3-first-policy-report.pdf

Popper, R. and Velasco, G. (eds) (2017) *Sustainable Innovation Policy Advice.* Second CASI Annual Report on policy developments and initiatives. http://www.casi2020.eu/app/web1/files/download/casi-second-annual-policy-report-e-book.pdf

CHAPTER I
Application of CASI MML methodology to policy formulation

Kamila Dobek, Poznan Science and Technology Park
Malgorzata Piotrowicz, Poznan Science and Technology Park

Abstract

The focus of this chapter is the potential application of a public participation approach to policy design at local and regional levels following the <u>CASI Mobilisation and Mutual Learning (MML) methodology carried out throughout the project.</u>

Public engagement, as applied in CASI, has proven to be successful in defining research priorities. Combining the language of laymen and experts in a mutual dialogue facilitated by specific methodologies and procedures seems to provide valuable input to knowledge generation and priority development (Ivanov et al, 2017). Having this in mind, wider public engagement creates opportunities to enrich the process of designing public policies in different areas (environmental, economic development, competitiveness etc.) at different levels (local to global, generic and sectoral). In comparison to conventional policy-making approaches it also has an important 'side effect', which is demonstrated in the strengthening of the ownership of policies and strategies among the wider public. Furthermore, including citizens' perspective into the policy design process puts the peoples' day-to-day concerns back to the heart of the public-sector priorities, which could result in changing the perception of exclusivity of conventional policy development process in the view of the wider public. Experiences showing the citizen engagement potential in designing development goals come inter alia from the World Bank (Manroth et al, 2014). The specific multi-stage "citizens-experts-citizens" (CEC) process applied in CASI and building on CIVISTI methodology[1] dynamically bridges both laymen and expert perspectives to facilitate mutual dialogue between socially shared values and institutionalised forms of knowledge (Repo et al, 2017). The process is aligned with the need for more inclusive approaches towards shaping public policy objectives in Europe and beyond as it addresses, in a structured and systematic way, important tensions coming from the gap between complex issues fuelled by peoples' hopes and fears and simple responses, which are too easily provided through conventional process of formulating policy agendas (sometimes reduced to mere slogans).

This chapter focuses on possibilities to scale-up the CASI experiences with "citizens-experts-citizens" process through policy design at local and regional level including INTERREG EUROPE programme.

Public participation in the development of policy priorities

The methodologies for elaboration of the regional development strategies and development of strategies of the cities take into consideration the involvement of stakeholders. The "Guide to Research and Innovation Strategies for Smart Specialisation (RIS 3)" states the following:

> "The fact that RIS3 is based on a wide view of innovation automatically implies that stakeholders of different types and levels should participate extensively in its design. The perhaps most common, tripartite governance model, based on the involvement of industry, education and research institutions, and government (the so-called Triple Helix model), is no longer enough in the context of smart specialisation. Innovation users or groups representing demand-side perspectives and consumers, relevant non-profit organisations representing citizens and workers should all be taken on board when the design process of RIS3 is in question. In other words, this means that the governance model includes both the market and the civic society. When it comes to the sensitive moment of deciding on strategic priorities, a truly inclusive RIS3 governance structure should be able to prevent capture by specific interest groups, powerful lobbies, or major regional stakeholders".

---

[1]   http://www.civisti.org/

From the above-noted it is evident that the involvement of the civil society is needed and recommended but so far mostly organised civil society groups (e.g. NGOs) that represent the interests of citizens were participating in the processes. There are only few methods for translating the needs, opinions and recommendations of citizens (including people with different level of education), which can enrich policy priorities development processes at different levels. CASI experiences with citizens' panels show the feasibility and value of such participatory approaches.

The experiences of Poznan Science and Technology Park (Poland) participating in the process of development of regional innovation strategies of the Wielkopolska region, first in 2002-2004, then in 2014 (RIS3), show that the participatory process was always focused on stakeholders that included representatives of universities and Research and Development (R&D) units, SMEs, intermediaries, as well as some NGOs. The process of consensus building was rather new in Wielkopolska region. Before the RIS exercise (elaboration of Regional Innovation Strategy in a participative process following EU methodology[2]), policy priorities were defined by public administration with the support of experts, sometimes followed by public consultations of prefabricated documents. The regional operational programme documents were consulted with stakeholders but not created in cooperation with them. During the RIS process the consensus building was launched – a very important step for Wielkopolska region, but still lacking the public engagement of citizens.

Public participation shaping local and regional polices

The CASI engagement methodology focused on translating the visions of citizens into research priorities can be very useful to work with different groups of citizens on local and regional policy priorities. It can also serve as inspiration for new methods of translating the ideas of non-experts to be used in sophisticated policy development processes.

Considerable guidance for policymakers:

- As understood in CASI, the citizens are lay people/lay experts making contributions as **members of society** with focus on the common good or/and **private individuals** with special interests as employer/employee, patient, etc. Both perspectives are very important when developing visions to ensure the balance between general and personal views.

- CASI citizens' panel methodology with three main steps can be adapted by policymakers and public administration working on local and regional policies. The steps are as follows:

  o First citizen panel to develop citizens' visions of the future

  o Expert panel to "translate" citizens' visions into research priorities

  o Second citizen panel to validate research priorities elaborated by the experts

- The experience of CASI citizen panels conducted in Poland shows that to engage more people in public participation, the following elements shall be taken into consideration:

  o Effective and attractive information about possibility and importance of participation;

  o Information focused on specific target groups, using adequate/accessible language;

  o Communication channels adjusted to target groups (information for seniors in senior's clubs, for youths in schools and in social media);

  o Informing about the process in advance and sending reminders;

  o Publishing good practices of public participation outcomes;

  o Media, as well as social media and local government should be involved with a view to reach citizens;

---

[2] "Management of a RIS project: Lessons from 10 years' experience" Innovating Regions in Europe Network – RIS Methodological Guide Stage 0, IRE Secretariat, July 2005.

- o Expected outcome should always be presented prior to the start of the process and ahead of each meeting;

- o Public participation process must be well prepared and follow well-defined methodologies;

- o Benefits of participation should be presented.

Public participation on local level in Leszno City, Poland – A case study

The challenges faced by Leszno city (65,000 inhabitants) are related to: spatial problems of the city divided not only by economic and social factors into poor (old town, old blocks of flats, brownfields) and rich areas (detached houses), but also divided by railroad tracks, isolation of deprived neighbourhoods, as well as the problems of brain drain to larger and better developed cities (Poznan and Wroclaw). These challenges call for a more integrated and innovative approach to public policy. The solution for the city was found in combining wide range of ideas that are complementary, including new public participation policy endorsed by the city, experimental search resulting in implementation of proposals aimed at solving the problems as well as evaluation of the outcome and its results. Public participation shall be further supported and moderated by Leszno city, scientists, experts and animators to assist citizens and local organisations in the process.

Leszno focuses on development of social capital for long-term change in synergies with model revitalisation, and public services for implementation of the strategy for social and economy development 2030 of Leszno in partnership with adjacent communes and local NGOs. It aims at creation of meeting and networking opportunities by engaging broader group of stakeholders and citizens.

Leszno policy-making practices have undergone an evolution from top-down towards a more participatory policy-making, and the city mission already includes participatory and inclusive functions. Nevertheless, the participatory approach – "for the people, by the people and with the people" – on every step of policy cycle is a novelty for all target groups, including citizens and municipality.

Leszno city integrates different approaches in urban policy for sustainable and inclusive city taking into consideration the following three key aspects:

- Integration of bottom-up and top-down approach in creation of policies and interventions by introduction of public participation policy into the municipality practices – from assessment/diagnosis phase (previously people complained and public bodies and external experts diagnosed them) to planning, testing, implementing and evaluating;

- Creation of linkages and networks for meeting the needs of different groups of the city community overcoming the divisions (spatial, social, irregular development) and tension in the city;

- Integration of different sectoral policies: education, culture, sport, health and well-being, entrepreneurship and economic development with social support – poverty alleviation, support for solving social problems, urban regeneration and spatial development, public infrastructure, etc.

Although Leszno city is at the beginning of the process of public participation policy implementation, many policy initiatives that resulted from the activities that involved citizens have already been or are being implemented.

INTERREG EUROPE – focus on interregional learning

The INTERREG EUROPE programme has an ERDF budget of EUR 359 million for the 2014-2020 period. It is the only INTERREG programme that covers the whole European Union. It was designed to support policy-learning among the relevant policy organisations with a view to improving the performance of regional development policies and programmes. INTERREG EUROPE addresses mainly regional and local public authorities, but also other regional actors across Europe, thus facilitating the exchange of practices and ideas on how public policies work, and exploring solutions to improve strategies for the benefit of their citizens (Interreg Europe, 2016).

Currently there are 130 projects running within INTERREG EUROPE and the last call was open for new international partnerships on 30 June 2017.

It seems that CASI public engagement methodology has a great potential to be adapted to and for interregional learning processes. The CASI experience could be scaled-up by adopting the methodologies to regional stakeholder groups, which is a mandatory component of each INTERREG EUROPE project.

Potential for embracing CASI experience into stakeholder group element

Project partners within INTERREG EUROPE are encouraged to pay attention to multidimensional aspect of the learning process (including individual, organisational, stakeholder and external level) to maximise the project's potential impact. Partners should propose in their projects ways in which exchanging of experience can directly influence the policy frameworks of the participating regions. Programme recognises that learning at the individual level alone is not sufficient to achieve policy change. Instead, learning outcomes need to be transferred and integrated effectively into the participating organisations and shared with the relevant stakeholders. This is the rationale behind the creation of stakeholder groups for each policy instrument addressed by the project activities within INTERREG EUROPE (Interreg Europe, 2016).

Interregional learning process is in the core of the INTERREG EUROPE interest. It is building on interregional exchange of experience and has both individual and institutional dimensions. The programme does not impose any specific methodology. It only requires that activities planned within each project answer to the needs of the participating regions and lead to an efficient learning process among the partners and the stakeholder groups. Recognising the complexity of policy-making process, the programme requires the project partners to set up and coordinate groups of intra-regional focus constituted by players from each region to increase the chance of achieving policy change for the sake of the citizens. The stakeholder group should involve organisations and individuals that are important for the definition of public policy. The involvement of stakeholders in the regional groups increases the ownership of the proposed improvements of policy measures addressed within the project. These improvements should be formulated within the project in a form of Action Plan for each policy measure addressed. The INTERREG EUROPE programme manual refers to URBACT local support group toolkit[3] as a good practice approach to be used while working with the stakeholder group.

CASI experience provides a complementary methodology, which allows more sustainable approach involving not only stakeholders and experts into the process but also the laymen perspective of citizens. The CASI experience of citizen panels adopted by INTERREG EUROPE stakeholder group would go beyond the typical composition of the group, recognising the relevance of citizens – who are neither directly responsible nor benefitting from those measures – for design and improvement of policy instruments. The CASI experience shows that involvement of such additional perspective is beneficial towards the improvement of the policies in long-term, as well as for the sustainability of results.

Concluding remarks

To conclude, CASI offers hands-on solutions for organising and executing workshops of citizen panels in a multi-national consortium. It presents tested methods of translating the citizens' concerns into policy priorities and creates opportunities for introducing them into sophisticated policy development processes. The "citizen-expert-citizen" approach delivered by CASI partners faithfully addresses people's concerns, which are often underestimated or absent in the policy-making process. Pursuant to the CASI methodology adopted for policy-making purposes, the citizens were first to define the directions of policy improvements (by defining visions of desirable future).

Secondly, the feedback on citizens' input provided from the expert perspective via expert panel, served to analyse, cluster and translate the visions into directions for policy improvements (with possible international dimension of the expert panel as an added value to the INTERREG learning process objectives). Finally, the research priorities defined by experts were validated and confirmed by the citizens.

---

3   http://urbact.eu/sites/default/files/urbact_toolkit_online_4_0.pdf

The CASI experience with citizen panels demonstrated that "whereas citizens tend to emphasise the importance of multi-dimensional and holistic development, in which ecological, social and economic components complexly interact, experts focus on the elaboration of narrower and more specific questions and challenges. The normative tension between perspectives is illustrative of the broader need for more inclusive, sustained and continuous cooperation between science and society at different stages of the policy-making and innovation processes. At the same time, it calls for the careful and proactive forging of public engagement frameworks that allow for complementary (or indeed diverging) values, norms, and propositions to be acknowledged and put into context, to ensure greater accountability to a larger group of participants and societal stakeholders" (Ivanov et al, 2017). CASI provides very specific toolkit of methodologies including specific agendas of citizens' panels, templates for reports and experiences of how to select and organise the experts' panels as well as the whole logic of the public engagement mechanism tested by international consortium of 19 partners, which can be adapted to the needs of interregional learning process in INTERREG EUROPE projects. Including citizens as relevant actors in the process of policy-making would bring another perspective towards collaboration of societal stakeholders in intra-regional and inter-regional dimension within INTERREG EUROPE.

References

Interreg Europe (2016) *Interreg Europe Programme Manual* (version 4),
https://www.interregeurope.eu/fileadmin/user_upload/documents/Call_related_documents/
Interreg_Europe_Programme_manual.pdf

European Commission (2012), Regional Policy, *The "Guide to Research and Innovation Strategies for Smart Specialisation (RIS 3)*, http://ec.europa.eu/regional_policy/sources/docgener/presenta/smart_
specialisation/smart_ris3_2012.pdf

Ivanov, K., Kozarev, K., Damianova, Z., Matschoss, K., Repo, P. and Bedsted, B. (2017) 'Sustainable Innovation Policy Advice Using a Citizen-Expert-Citizen Approach to 'Aspirations' Mapping,' in Popper, R. and Velasco, G. (eds) *CASI Sustainable Innovation Policy Advice*. Bulgaria: Applied Research and Communications Fund.

Manroth, A. *et al.* (2014) *Strategic Framework for Mainstreaming Citizen Engagement in World Bank Group Operations*. Washington, D.C.: World Bank.
https://openknowledge.worldbank.org/handle/10986/21113

Repo, P., Matschoss, K., Tregner-Mlinaric, A., Van Eynde, S., Ramioul, M., Damianova, Z. and Kozarev, V. (2017) 'Sustainable Innovation Policy Advice Using a Policy Watch Approach to 'Policies' Mapping,' in Popper, R. and Velasco, G. (eds) *CASI Sustainable Innovation Policy Advice.* Bulgaria: Applied Research and Communications Fund.

CHAPTER II
How to reach stakeholder involvement in collaborative settings? Evidence from country-based networks in CASI

Mattia Martini, Università di Milano Bicocca

Abstract

The concept of stakeholder involvement is central in the discourse regarding research process and decision-making activities and becomes even more crucial where the aims of these initiatives regard sustainability and sustainable innovation issues.

Stakeholder involvement and public engagement (PE) are now at the core of Responsible Research and Innovation (RRI) strategy at European level. RRI implies that societal actors (researchers, citizens, policymakers, business, third sector organisations, etc.) work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of the entire society. Accordingly, we observe a growth in the PE initiatives both at the EU and non-EU level. In addition, by financing Mobilisation and Mutual Learning Action Plan (MMLAP), the European Commission is aiming to develop new forms of dialogue and cooperation between science and society at different stages of the research and innovation process, by proactively forging partnerships with complementary perspectives, knowledge and experiences.

Introduction

The capacity to involve and activate different stakeholders is crucial for decision-makers involved in sustainability-oriented initiatives and innovations. Yet, in the context of sustainability, stakeholder integration may offer many advantages for managing innovation (Berkout, 2014):

- social effect of innovations can most accurately be assessed by integrating the affected stakeholders directly into the assessment process;

- the integration of stakeholders reduces the risk of being the sole party responsible if sustainability problems arise as a consequence;

- the integration of stakeholders' complementary implicit knowledge into the innovation process can inspire new innovation.

Following the above discourse, it becomes crucial – for both policymakers, research institutions and private and non-profit organisations – to find out effective strategies and practices which may help in engaging and involving different stakeholders and better managing the interactions between them. In this regard, the literature on governance and public networks can be used as a reference framework. Several authors within this stream of literature have highlighted the importance of managers' skills and abilities and managerial strategies for network success (e.g. Klijn *et al.*, 2016). The scholars have also introduced a contingency approach which functions better in explaining how the effective network management mechanisms can vary in combination with some contextual and structural network characteristics (Verweij *et al.*, 2013; Raab *et al.*, 2015; Wang, 2016; Cristofoli and Markovic, 2016).

The aim of our contribution is to try to shed light on the conditions of success of collaborative settings where the capacity of engaging and involving different stakeholders for reaching specific objectives is required.

The empirical context of our study is represented by the country-based networks of stakeholders managed by the CASI partners all along the project duration, and aimed at involving and engaging different actors for the development of a common framework for the assessment and management of sustainable innovation (see Popper *et al.*, 2017). The results of our study can inform all those institutions

involved in MML project and public engagement (PE) initiatives, providing specific guidelines to be more effective in reaching their objectives.

The chapter begins by describing the empirical framework and the research methods; it proceeds by presenting and discussing the main findings, while at the end some final considerations are presented.

Empirical framework

Collaboration among parties involved in multi-stakeholder project is paramount for their success. Under the managerial standpoint, different strategies and mechanisms can be activated to reach good level of collaboration in different structural and institutional environments. Identifying these strategies and mechanisms is the aim of our study.

We develop an empirical framework (see Figure 2) that has been built in terms of both the theoretical background that informs it and the specific hypotheses that it entails, using stakeholder involvement as the criterion variables and network culture, managerial strategies and coordination mechanisms as explanatory variables.

The assumption behind this framework is that in centrally-integrated network the effective stakeholder involvement can be achieved through different managerial strategies and coordination mechanisms.

With the term "managerial strategies" we refer to the "deliberate attempt to govern processes in networks" (Klijn *et al.*, 2010), distinguishing between connecting strategies, exploring content strategies, arranging strategies and process agreement strategies. In this study, we consider only managerial strategies of connecting and process agreement. The first deals with the management of the process of partner interaction, while the second is more related to the design of the institutional rules shaping the partner interaction.

Coordination mechanisms are defined as formalised instruments and tools normally employed to sustain partner interaction. They are normally categorised into three main groups: integration mechanisms, coordination mechanisms and control mechanisms. In our study, we focus on coordination mechanisms which concern the organisation of meetings, the definition of agendas and establishment of procedures for partner interaction and decision-making processes.

Finally, and according to a contingent approach, we hypothesised that the overall effectiveness of network management in achieving stakeholder involvement may be affected by the culture that characterises the networks. According to the literature, organisational culture refers to a property of the implicit and explicit organisational design principles, which encompasses values and behaviours that "contribute to the unique social and psychological environment of an organisation" (Schein, 1985). In our study, we distinguish between group culture, which is typically focused on people, flexibility and employee cohesion, and hierarchical culture, instead of focusing mainly on procedures, control, and organisational stability (Quinn and Kimberly, 1984).

Figure 2: Empirical framework

Empirical context

The CASI project represents an extraordinary rich empirical setting for the purposes of our study. It is based on 19 successful country-based networks covering 12 EU countries (Austria, Belgium, Bulgaria, the Czech Republic, Germany, Denmark, Finland, Italy, Poland, Portugal, Slovenia, UK) and made up of the project partner and its stakeholders, where high level of stakeholder involvement have been reached in different structural and institutional contexts through the managerial abilities and mechanisms activated in each of these structural and institutional environments.

CASI is an EU project funded within the theme "Mobilisation and Mutual Learning (MML) Action Plans". It has envisaged numerous activities aimed at involving the quadruple helix actors of sustainable innovation (i.e. government, business, civil society and research and education). Stakeholder involvement was aimed at developing a common framework for the assessment and management of sustainable innovation. From the beginning of the project, each of the 19 project partners in CASI has managed a country-based network of actors, including public, private and non-profit organisations involved in projects of sustainable innovation. The specific aim of the country-based networks was to co-design and assess the CASI framework, providing feedback and suggestions for its development and improvement.

In our study, we focus attention on the networks of the so-called "core stakeholders", and then those actors that were involved in a "stable" relationship with the partners during the CASI project and who took part in different CASI initiatives (e.g. mapping, stakeholder workshop, citizen panels, policy conference, etc.).

Methodology

Data were collected through an online questionnaire and submitted between June and July 2016 by the 19 CASI partners (the leaders of a country-based network of stakeholders). The purpose of the survey was to gain more insight into the functioning of procedures, network management, network culture and stakeholder involvement. The survey was structured into different sections that investigated:

- The characteristics of the collaboration among the project leaders and the stakeholders involved in the country-based networks;

- The relationships and the level of trust among the involved organisations;

- The structure, management, governance and the performance of the collaboration.

The questionnaire was first piloted with the three Italian CASI partners and modified according to their feedback. The final survey was sent out to all the CASI partners in an internet-based format, which took about 20 minutes to be completed. All partners took part in the survey, but only 18 of them provided the information that was sufficient for subsequent analysis. To better understand the characteristics of the country-based networks and the managerial strategies and mechanisms adopted by the network leaders, an open questionnaire was finally sent to the participants in February 2017.

All the variables are based on network leaders' perceptions and measured using seven-point Likert scales (1=totally disagree, 7=totally agree). Multi-item measures were used for these variables. To assess the reliability, the Cronbach's alphas (CA) was calculated with an acceptance level of 0.70.

Stakeholder involvement was measured by 5 items adapted from Kort and Klijn (2011) focused on process-related measures of stakeholder involvement (an example of item being "There has been enough interaction with parties with different opinions"). Managerial strategy was measured by a scale of 8 items adapted from Klijn *et al.* (2010), where 4 items were built to detect process agreement strategies (an example of item being "In the agreements on the stakeholder involvement initiatives, room has been consciously built in for deviating from the plan, if this is of advantage"), whereas the other 4 items served to detect connecting strategies (an example of item being "There is satisfactory time devoted to the communication with the stakeholders"). Coordination mechanisms were measured by 3 items adapted from Cristofoli and Markovic (2016) (an example of item being "The coordination of each other's activities is based on standard operating procedures"). Finally, network culture was measured by a scale of 6 items adapted from Moynhian and Pandey (2007), where 3 items aim to detect the presence of a

hierarchical culture (an example of item being "Bureaucratic procedures generally govern what parties in this network do"), whereas the other 3 items detect the presence of a group culture (an example of item being "The network is a very personal place").

Data were analysed through the Crispy Set Qualitative Comparative Analysis (QCA) to investigate the combinations of network management, network mechanisms and network culture which can lead to high stakeholder involvement. Accordingly, each variable was then dichotomised, where binary variables with "0" indicating the absence of a condition, and "1", the presence of certain condition.

Results and discussion

Results of data analysis show that 10 country-based networks out of 18 can be considered "successful networks" as they have reached high level of stakeholder involvement.

Within these 10 country-based networks, the QCA distinguishes two different paths that equally lead to high stakeholder involvement. The first path is characterised by the presence of a group culture. The second path is characterised by the presence of a hierarchical culture, the adoption of process agreement strategies and formalised coordination mechanisms. As shown in table 1, the second configuration has a greater importance from an empirical point of view, as its raw coverage is equal to 0.66, while that of the first path is equal to 0.16.
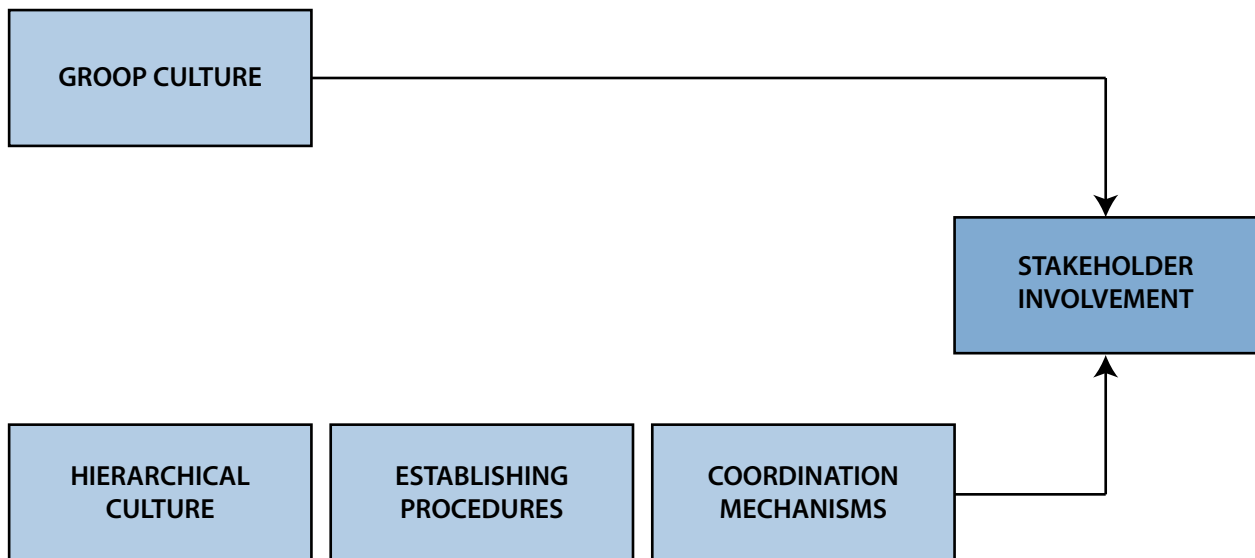
Figure 3: Paths leading to high stakeholder involvement

Table 1: Results of the csQCA

	Raw coverage	Unique coverage	Consistency
Path 1	0.166667	0.166667	0.166667
Path 2	0.666667	0.666667	0.666667
Frequency cut-off: 1.000000		**Consistency cut-off: 1.000000**	
Intermediate S			

Solution coverage: 0.833333
Solution consistency: 1.000000

Within the networks we have found both types of network cultures. However, hierarchical culture seems to characterise most of the country-based networks which were built in CASI (8 out of 10). This result can be justified considering the empirical context used for our analysis. The EU projects indeed almost always include high levels of formalisation and procedures. This is particularly needed when complex activities

are to be carried out by coordinating a significant number of partners, especially when several countries are involved. Within this context, the project coordinator and WPs leaders typically play a central role in coordinating partners and provide rules and guidelines for accomplishing the tasks assigned. As stated by a project leader "the network activities were planned and carried out according to the CASI project plan, the guidelines included in the cook-book, and our responsibilities within the tasks."

Depending on the type of the prevalent culture within the network, two different paths seem to be equally effective in getting high stakeholder involvement. The first one involves the presence of a hierarchical culture, that when associated with process agreement strategies and formalised coordination mechanisms can lead to high stakeholder involvement. This is the predominant configuration in the cases analysed and, as mentioned above, is consistent with the features of European projects. Instead, the second configuration is characterised by a group culture, where the presence of network management practices is irrelevant. Here, the presence of a group culture alone seems to be sufficient to lead to stakeholder involvement. Only two country-based networks present this configuration. In both cases, the network leaders describe their network as a very personal place, like an extended family, and where parties seem to share a lot of themselves. "The working atmosphere within the project is very positive. People are able to share their knowledge and experiences. Even from a personal point of view", said one project leader, and then added: "The partner interaction is governed by the personal relationships between the people involved; we pick up the phone and call each other, when necessary". Similarly, the other project leader described the mechanisms used to govern the partner interaction as "very informal. Face-to-face meetings, e-mails and social media were used to govern the partner interaction".

Our study confirms the relevance of network management, but only when it is applied in a network characterised by a hierarchical culture. If a network of stakeholders is led by hierarchy, the network leaders should then define and adopt clear rules and procedures for governing the interactions between the members. On the other hand, when a group culture characterised the networks, managerial strategies and coordination mechanisms may not be necessary to reach high stakeholder involvement. In these cases, no actors have a central position within the network, responsibilities are shared among all the network partners, and managerial mechanisms seem not to be necessary as the partners' interaction is governed by their behaviours, like "in an extended family".

Concluding remarks

Results of this study provide some relevant insights for managers involved in PE activities and/or projects and initiatives where stakeholders' involvement is increasingly expected (MML projects, sustainability-oriented initiatives, etc.). The study suggests to network leaders that different strategies for managing the networks of stakeholders could be equally effective for reaching their targets.

First of all, where the prevalent culture within the network is hierarchical, the adoption of common rules and coordination mechanisms for recruiting, involving and managing stakeholders can certainly lead to effective involvement. These results support the adoption of guidelines and standardised procedures provided to the network leaders for setting up and managing their stakeholder network. In the CASI experience, each public event was preceded by manuals and guidelines provided by the WP/task leaders, detailing the activities and tools that should be used by the partners to engage and promote the participation of the various stakeholders. In most cases (8 country-based networks) these procedures were strictly followed allowing network leaders to reach high stakeholder involvement levels. As the leader of one of these successful networks affirms: "We received a cook-book to prepare events of stakeholder engagement."

On the other hand, some margins of freedom could be granted to the network leaders in adopting personalised and even more informal involvement strategies, where the partners deem it appropriate. In particular, our study demonstrates that the adoption of procedures and standards may not be necessary, if not even harmful, in that network where a group culture prevails, and hence the collaborative environment is characterised by high levels of mutual trust and shared goals. How can then a group culture within the network of stakeholders be promoted? To favour this kind of culture, the criteria adopted to recruit members and their overall level of commitment to achieve the network objectives become particularly relevant, as emerges from the interviews with the network leaders.

With regards to the recruitment strategy, the previous knowledge among members, or at least among the members and the network manager seems to be essential. As one network manager affirms: "Stakeholders were recruited according to those who were the targets of the EU project, but certainly also based on what was my direct knowledge of these stakeholders and their area of work and interest. Indeed, most of them are people I have worked with before in a different way. These are entrepreneurs and people already involved in the world of work, with whom I shared a career in training and consulting, but also people I knew outside the professional context, in private life, of whom I knew the potential interest for the issues addressed in the specific EU project."

The fact that a network can rely on a pool of at least few members, which strongly share the topics and are committed to the objectives and aims of the network, may be a prerequisite for relying on a group culture within the network. As affirmed by an interviewed network leader: "From many government, business, civil society and research and education actors only a small proportion can be described as having a stable relationship, as they participated in several activities. These are definitely business actors (innovators involved in mapping, piloting and events) and a few researchers who are very engaged and closely observed project developments."

References

Berkout, F. (2014) 'Sustainable Innovation Management,' in Dodgson, M., Gann, D. M. and Phillips, N. (eds) *The Oxford Handbook of Innovation Management*. Oxford: Oxford University Press.

Cristofoli, D. and Markovic, J. (2016) How to make public networks really work: A qualitative comparative analysis. *Public Administration.* 94 (1): 89–110.

Klijn E.H., Sierra, V., Ysa, T., Berman, E., Edelenbos, J. and Chen, D.Y. (2016) The influence of trust on network performance in Taiwan, Spain, and the Netherlands: A cross-country comparison. *International Public Management Journal.* 19 (1): 111-139.

Klijn, E. H., Steijn, B. and Edelenbos, J. (2010) The impact of network management on outcomes in governance networks. *Public Administration.* 88 (4): 1063-1082.

Kort, M. and Klijn, E. (2011) Public-private partnerships in urban regeneration projects: Organizational form or managerial capacity? *Public Administration Review.* 71 (4): 618-626.

Moynhian D.P. and Pandey, S.K. (2007) The role of organizations in fostering public service motivation. *Public Administration Review.* January-February: 40-53.

Popper, R., Velasco, G. and Popper, M. (2017) *CASI-F: Common Framework for the Assessment and Management of Sustainable Innovation*, CASI project report. Deliverable 6.2.

Quinn and Kimberly, (1984), Diagnosing and Changing Organizational Culture, Based on the Competing Values Framework. Revised edition, the Jossey-Bass Business & Management Series.

Raab, J., Mannak, R.S. and Cambré, B. (2015) Combining structure, governance, and context: A configurational approach to network effectiveness. *Journal of Public Administration Research and Theory.* 25 (2): 479-511.

Schein, E.H. (1985) *Organisational Culture and Leadership.* San Francisco: Jossey-Bass Publishers.

Verweij, S., Klijn, E.H., Edelenbos, J. and Van Buuren, M.W. (2013) What makes governance networks work? A fuzzy set qualitative comparative analysis of 14 Dutch spatial planning projects. *Public Administration: An International Quarterly.* 91 (4): 1035-1055.

Wang W. (2016) Exploring the determinants of network effectiveness: The case of neighborhood governance networks in Beijing. *Journal of Public Administration Research and Theory* 26 (2): 375-388.

CHAPTER III
Transdisciplinarity in sustainable innovation research: Networks of mutual learning

Sarah Van Eynde, KU Leuven
Ventseslav Kozarev, ARC Fund

Abstract

This chapter discusses networks that may emerge because of Mobilisation and Mutual Learning Action Plans (MMLAP's) and to what extent those networks reflect the transdisciplinary nature of research on so-called wicked problems. By visualising the network of societal stakeholders and citizens that were engaged during four activities organised during the lifespan of the CASI project by three CASI partners, the chapter demonstrates that transdisciplinary networks on sustainable innovation span boundaries between different societal stakeholders of which some hold key structural positions in the network that affect mutual learning. The conclusion reflects on the implications of transdisciplinary network structures for mutual learning.

Introduction

Complex societal problems or wicked problems such as climate change or the energy problem are persistent issues "embedded in our societal structures; uncertain due to the hardly reducible structural uncertainty they include; difficult to manage, with a variety of actors with diverse interests involved; and hard to grasp in the sense that they are difficult to interpret and ill structured" (Dirven *et al.*, 2002, cited in Rotmans and Loorbach, 2009: 185).

Transdisciplinary research stems from the idea that complex socio-environmental problems or wicked problems will not be solved by narrow or monolithic solutions, like for example intensifying agriculture to fulfil the human need for food or exploiting fossil fuels and building large dams to fulfil the human need of energy (Brown *et al.*, 2010). Such narrow solutions are unable to inform sustainable decision-making, which meets the needs of the present without compromising the ability of future generation to meet their own needs (United Nations, 1987).

A different approach towards research that can inform decision-making is therefore put forward as an attempt to resolve wicked problems: transdisciplinary research. Transdisciplinary research refers to the collaboration between societal stakeholders from, for example, science, industry and politics to find solutions to complex societal problems by organising processes of mutual learning between science and society (Scholz *et al.*, 2000). Mobilisation and Mutual Learning Action Plans (MMLAP) therefore seem to be a fruitful mechanism to adopt in transdisciplinary research projects, and have been consistently supported by the European Commission through project funding in the Working Programmes of FP6, FP7 and in Horizon2020. MMLAPs are partnerships that span multiple societal stakeholders, perspectives, knowledge and experiences to ensure that research and innovation that address societal challenges are relevant and responsive to societal needs and can be effectively implemented; they are also the combination of different collaborative methods whereby these various stakeholders interact towards a shared goal.

In CASI, the development of the assessment and management framework for sustainable innovations, also known as CASI-F (see Popper *et al.*, 2017) has been carried out with the help of several consultative and co-creative rounds with different societal stakeholders in different EU Member States. CASI partners who were responsible for organising those consultative and creative activities have played a pivotal role in bringing together societal stakeholders with a background in academia, business, government, civil society, including citizens. The group of stakeholders which CASI partners engaged during those activities can be regarded as a network, understood as a structure composed of a set of actors, of which some are connected by one or more relations (Knoke and Yang, 2008: 8; Scott, 2012). Since these stakeholders were engaged in discussing sustainable innovation, we can say that networks on sustainable innovation have emerged in the different EU Member States as a result of CASI activities. Networks are considered as a relevant analytical concept to study transdisciplinarity in mutual learning, especially from a network

structure point of view. It assumes that societal stakeholders and citizens are embedded in a social setting and that those relationships are very important in determining both stakeholders and citizens' individual behaviour – such as attitudes towards and behaviour concerning sustainable innovation – and societal outcomes at large – such as whether a region or community succeeds in finding solutions for sustainable problems such as mobility.

The next section first discusses several network parameters that seem relevant when analysing mobilisation and mutual learning networks. It then presents the network of 245 stakeholders that participated in four activities organised by three CASI partners: citizen panel meetings, a mutual learning seminar, a stakeholder workshop and a policy dialogue. During those activities, participants had the opportunity to discuss and share views about one or more topics related to sustainable innovation.

Mutual learning in transdisciplinary networks on sustainable innovation

In networks, learning can occur at multiple levels (Heikkila and Gerlak, 2013: 486). It can occur at the level of individuals to small subgroup levels within a network, to larger groups within a network, to learning at the level of the whole network. In structural terms, it depends on the level of interconnectivity (or edges) between stakeholders (or nodes) in the network. The amount of potential edges in a network that are actual edges is called network density. If a network consists of, for example, 80 individual societal stakeholders and citizens, they can potentially all be connected to each other. Knowledge or ideas of one individual societal stakeholder reach all other societal stakeholders in this case. It might explain why there are multiple views or perceptions exchanges among all individual societal stakeholders, meaning that if one would ask one societal stakeholder about the perceptions or ideas of others, (s)he will be able to tell who has what kind of ideas vis-à-vis a particular societal socio-environmental problem.

If all individual societal stakeholders are not connected to each other, some societal stakeholders will need some particular stakeholders to disseminate knowledge or information to other stakeholders. In other words, because stakeholder A is not connected to stakeholder C, (s)he depends on stakeholder B to transmit knowledge or ideas from stakeholder A to C (see Figure 4).
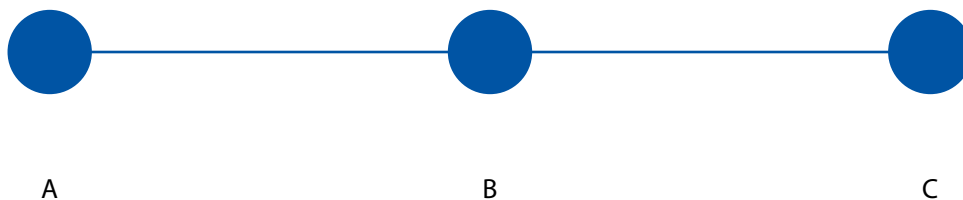
Figure 4: Central stakeholders in networks

That is why another important measure that potentially affects learning in networks is centrality. When a stakeholder plays a central role in a network, (s)he can be regarded as a 'broker', 'agent of knowledge', 'key gatekeeper', or 'network manager' (Benz & Fürst, 2002; Kramer & Pahl-Wostl, 2014; Rantala, 2012). There are two different centrality measures: closeness and betweenness centrality. Closeness centrality refers to the level of a stakeholder's closeness to any other stakeholder. When a stakeholder should only take a number of steps to reach all other stakeholders, that stakeholder can potentially acquire and transfer knowledge more efficiently than other stakeholders (Hafner-Burton and Montgomery, 2010). The number of times that any stakeholder needs another stakeholder to be able to reach any other stakeholder is defined as betweenness centrality (Borgatti and Everett, 2006). Stakeholders with high betweenness centrality have opportunities for assembling a great deal of knowledge and exerting control on knowledge flows that other stakeholders with low betweenness centrality do not have. In the example in Figure 4 stakeholder B has high betweenness centrality compared to stakeholders A and C and can exert control on the knowledge that flows from A to C.

Besides exploring network structure parameters, it is relevant to examine stakeholders' attributes. Attributes refer to specific stakeholders' characteristics such as age, gender, occupation and educational background or to more specific qualitative assessments related to the topic such as whether a stakeholder

considers the knowledge that flows through the network relevant for her/his own work or life. Especially when one is interested to explore the level of transdisciplinarity in networks, occupation or stakeholder type such as academic or research institutes, government, business, civil society or lay citizen is an attribute to consider. In CASI, a difference is made between societal stakeholders and citizens. Citizens are considered as individuals, whose positions and opinions are only reflective of their own selves. While a government official represents an institution, a citizen participates in an individual capacity, not necessarily reflecting any institutional opinion. Therefore, the "capacity" of being a citizen is associated with one's own personality and experience, irrespective of any organisational affiliation or position.

The figures below present the transdisciplinary network on sustainable innovation that emerged as a result of four CASI activities, organised between Spring 2015 and Autumn 2016. These activities were citizen panel meetings, a mutual learning seminar, a stakeholder workshop and a policy dialogue. The nodes represent individual stakeholders that participated in these four CASI activities. An edge (or link) between two stakeholders means that these two stakeholders participated together in one CASI activity. If two stakeholders participated in, for example, two activities, there are two edges between those stakeholders. The three CASI partners, which organised the four activities, were selected in a way which ensured that the networks in Figure 5, Figure 6, Figure 7, Figure 8, Figure 9 and Figure 10 reflected the diversity of partners of the CASI consortium. They included a university, a (non-profit) business-oriented consultancy and a municipality.
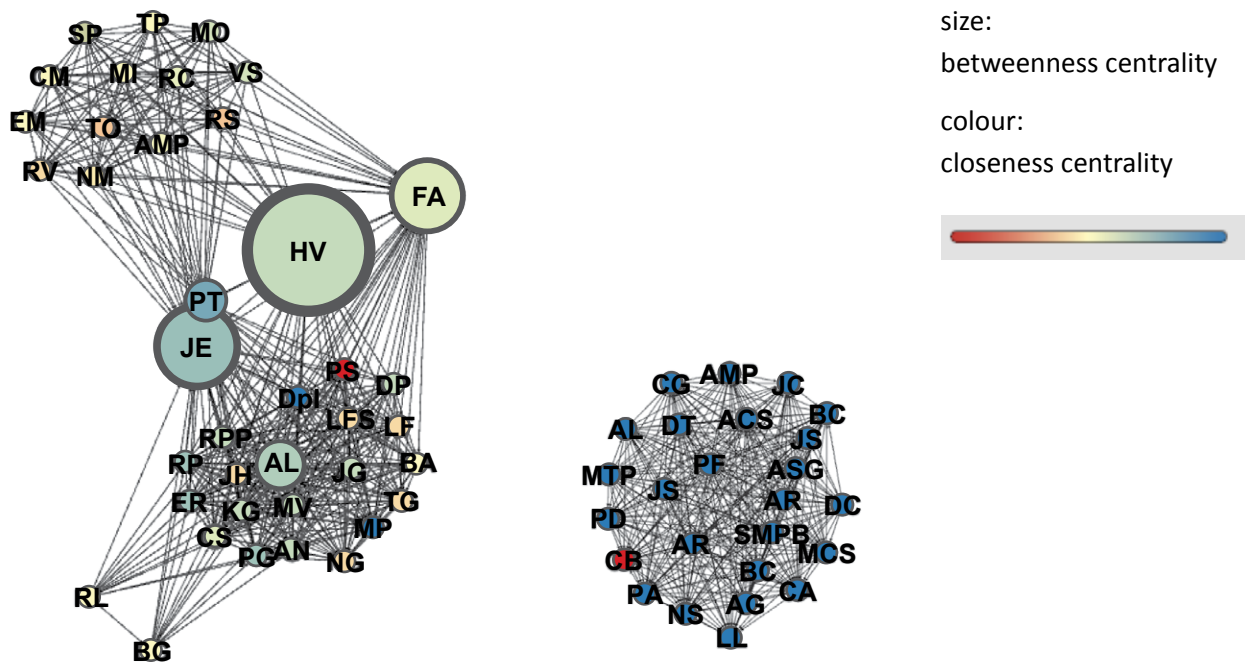
Figure 5: The transdisciplinary network of CASI partner A: centrality measures

Figure 5 presents the network that emerged due to four activities organised by one CASI partner. There are three very visible clusters, of which one is not connected to the other two. It appears that there are two separate subnetworks in the larger network. There are five stakeholders that have a relatively higher betweenness centrality: HV, JE, FA, AL and PT, suggesting that individual stakeholders to a large extent need these five specific stakeholders to reach other stakeholders. FA is a CASI partner with a background in government. JE is a stakeholder with a background in business. AL has a background in research and education. The colour of the nodes is an expression of closeness centrality, and ranges from red (low closeness centrality), to yellow (medium closeness centrality) to blue (high closeness centrality). The blue stakeholders are closer to the other stakeholders in the network and can reach them more efficiently. The cluster at the right-hand side of the network are all lay citizens, except for the red node labelled CB who is a CASI partner. In the cluster at the left-hand side of the network, there are only three blue nodes (DP, MP and PT). All three stakeholders have a background in business.

A closer look at background of stakeholders reveals that the cluster at the right-hand side of the network consists of mainly citizens, except for three stakeholders that have a background in business (see Figure 6). The cluster at the left-hand side at the top consists of mainly civil society and business stakeholders. At the bottom, there is a more mixed result including also stakeholders from research and education and one single stakeholder representing government. The stakeholders with the highest betweenness centrality are mainly business stakeholders, except for the one who represents research and education.

purple:
business

light green/yellow:
citizen

blue:
research and education

orange:
civil society

dark green:
government
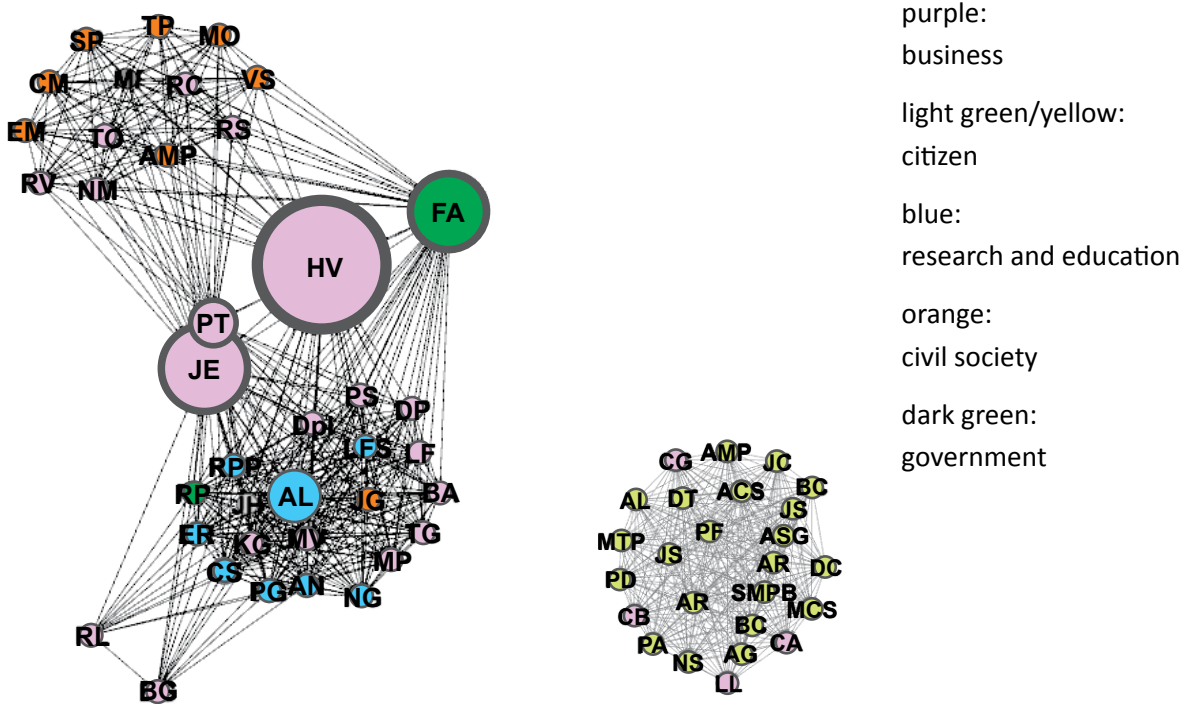
Figure 6: The transdisciplinary network of CASI partner A: stakeholder types

size:
betweenness centrality

colour:
closeness centrality
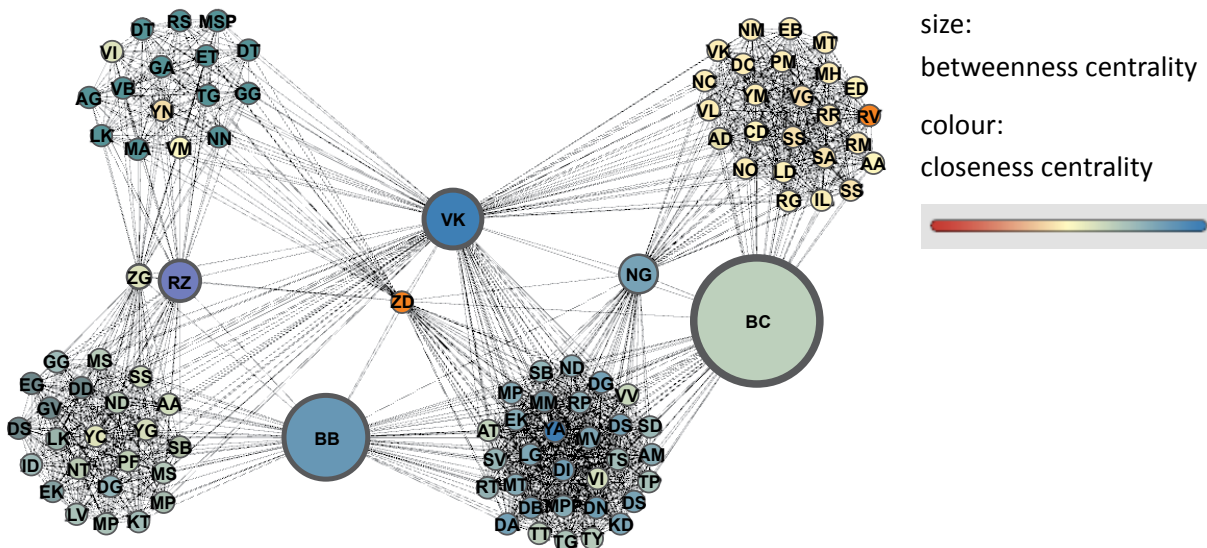
Figure 7: The transdisciplinary network of CASI partner B: centrality measures

In Figure 7 betweenness centrality is visualised with the size of the stakeholders. The larger the node, the higher its betweenness centrality. The colour of the nodes refers to closeness centrality, and ranges from red (low closeness centrality), to yellow (medium closeness centrality) to blue (high closeness

centrality). There are five nodes that have a relatively high betweenness centrality: BC, BB, VK, NG, and RZ. Except for RZ, all the central stakeholders are CASI partners. RZ has a background in research and education and participated in more than one CASI activity. Therefore, RZ is needed for stakeholders of one cluster to reach the stakeholders of another cluster. Most of the stakeholders with high betweenness centrality also have high closeness centrality scores.

Blue: research and education

Green: citizen

Orange: civil society

Purple: business

Dark yellow: government
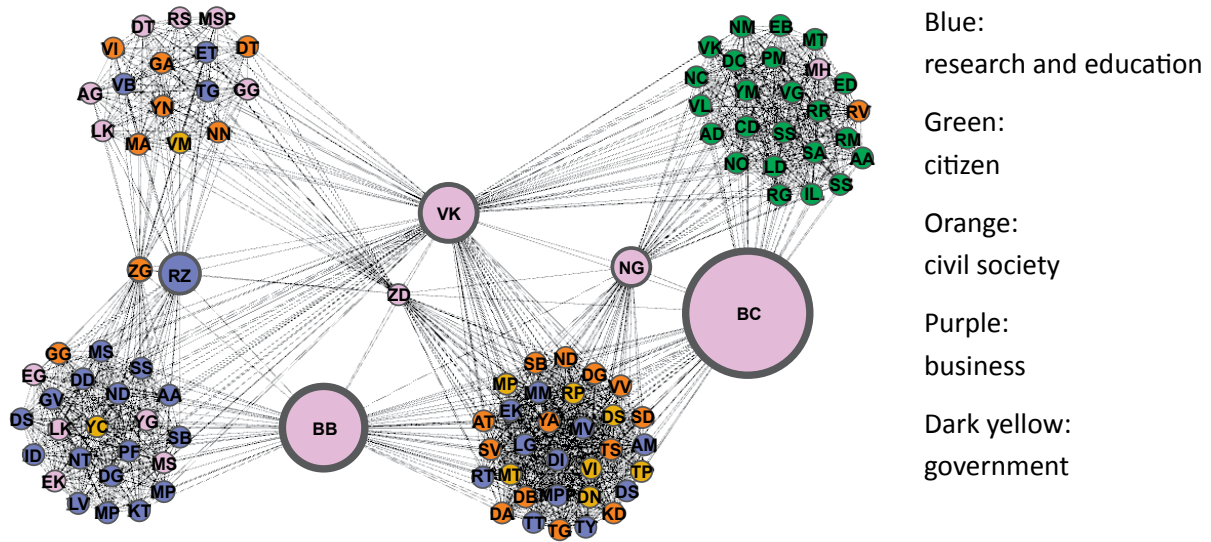
Figure 8: The transdisciplinary network of CASI partner B: stakeholder types

The most central stakeholders represent business and research and education (see Figure 8). Similar to the network presented in Figure 5 and Figure 6 we see one cluster with mainly citizens and other clusters with participation of a mix of stakeholders. In this network, there are relatively more stakeholders which represent government compared to the networks presented in Figure 5 and Figure 6. One cluster demonstrates a mix of government, civil society and research and education representatives, added by CASI partners who represent business. The other two clusters also present a mix of stakeholders. One at the bottom left consists of mainly research and education representatives. The other at the top left is a mix of business, civil society, research and education and government representatives.

size: betweenness centrality

colour: closeness centrality
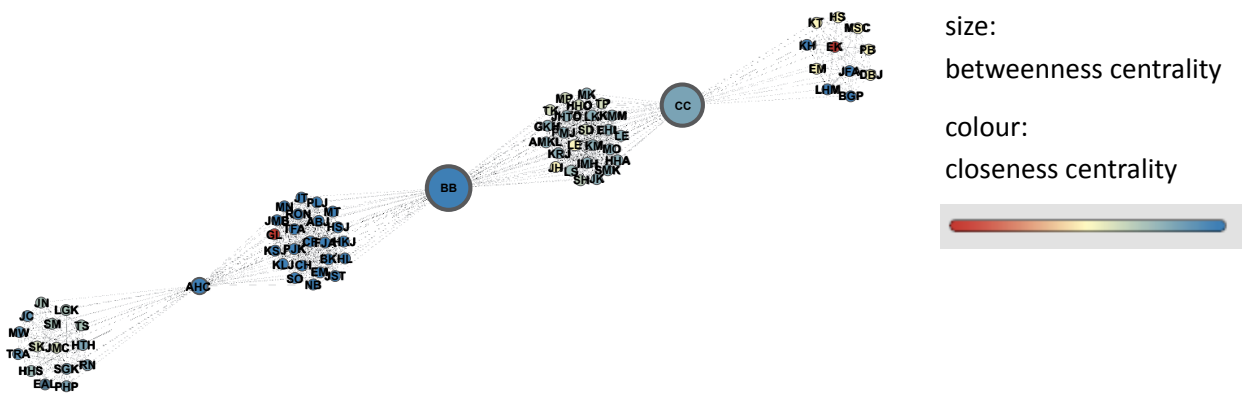
Figure 9: The transdisciplinary network of CASI partner C: centrality measures

Three stakeholders have relatively high betweenness centrality scores: BB, CC and AHC in the network of CASI partner C (see Figure 9). The three stakeholders are connected to all stakeholders of two clusters and share the connectivity with one of these two clusters with another of these three stakeholders. For example, CC is connected to the first and second cluster (starting to count from the right-hand side) of the network. BB is also connected to the second cluster. AHC and BB are CASI partners. CC represents an

academic and research institution. These three stakeholders also have relatively high closeness centrality scores. A few other stakeholders, however, are central in terms of closeness as well, which means that many stakeholders can reach very easily all other stakeholders.

The network of CASI partner C consists of mainly citizens (25 percent) and business representatives (23 percent; see Figure 10). Representatives from civil society and research and academic institutions represent a share of 19 and 18 percent. Only 3 percent of the stakeholders represents government. Like the other networks presented in Figure 4 and Figure 6, there is one cluster with mainly citizens. The other clusters are a mix of all other stakeholder types.

Purple:
citizens

Light green:
business

Light blue:
civil society

Orange:
Academic and research institution

Pink:
Government

Dark blue:
not available
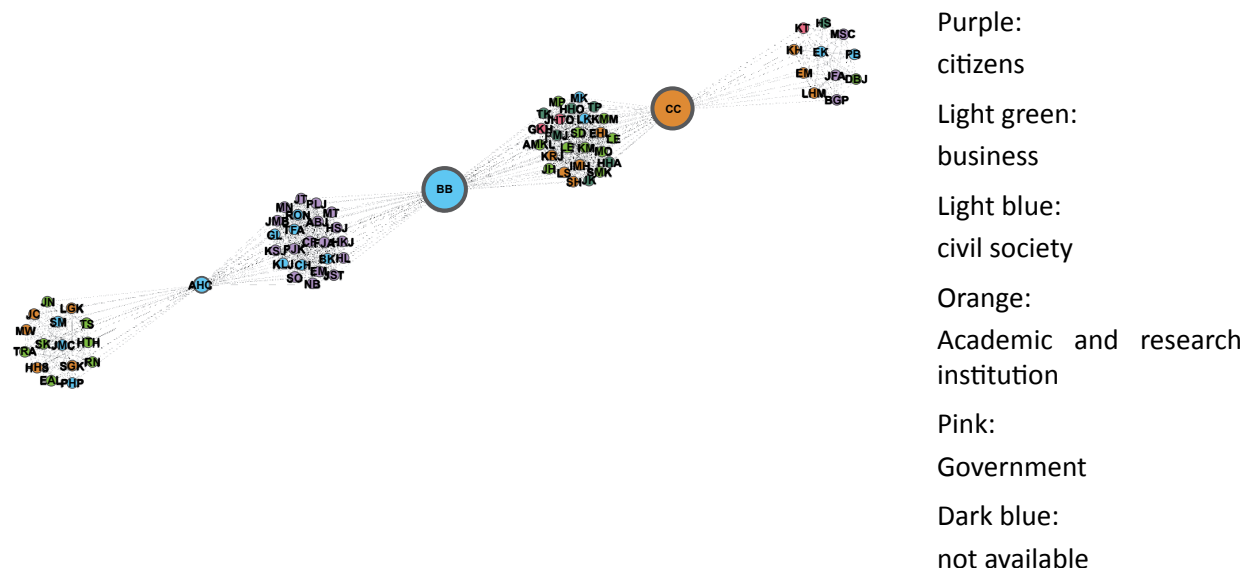
Figure 10: The transdisciplinary network of CASI partner C: stakeholder types

Concluding remarks: Outlook for mutual learning

These paragraphs reflect upon the findings as a result of the quantitative network analysis carried out in the previous section.[4] What might the found density measures, centrality measures and background (or stakeholder attributes) imply for mutual learning? And what lessons can we draw for mutual learning in transdisciplinary networks?

The CASI project relied on a complex MMLAP approach, having included major stakeholder types, in a variety of interaction settings, through multiple engagement methods. As such, CASI was an exemplary demonstration of the application of MMLAP, with all underlying complexities, to the addressing of a societal challenge (inclusive of a number of "wicked" problems).

The analysis of the networks, which represent the backbone of the MMLAP approach in CASI, reveals that an MMLAP can successfully mobilise a social network around an issue, or a range of related issues, which underlie the very same "wicked" problem being addressed by the action. In fact, key partners within an MMLAP become powerful drivers of such a network's formation. In terms of mobilization and learning, the exchanges, which the network produces, result in the development of a (more) widely shared understanding of the problem, of at least some of its underlying issues, and of some potential opportunities that may shape successful responses to these issues. Such responses may find expression through public policies, amendments in educational programmes, new corporate initiatives, better defined cross-sectoral collaborations, and could also help encourage innovation at multiple levels.

At the same time, this chapter only briefly demonstrates the potential of the application of social networking analysis to a project-based response, in this case – to Grand Societal Challenge 5-based problem. We recommend further and deeper inquiry into the network dynamics that result from such

---

4   Insights emerging from the qualitative assessment of the network of CASI partners can be found in chapter 9.

collaborations, particularly within the MMLAP construct, to reveal further insights into the importance of stakeholder collaborations and their sustainability over time. Such analysis could consider wider representation of more than one project partnership, and could further consider how MMLAPs help generate policy networks around issues defined by uncertainty and debate.

In this sense, the inclusion of citizens deserves special consideration. On the one hand, it is challenging to regard individual citizens in the same way as institutional stakeholders for the purposes of network-based analysis. On the other hand, such a challenge only emphasises a critical gap in the ability of policy-targeted systems to consider the inclusion of citizens, as well as the capacity thereof. CASI has made a significant step towards narrowing that gap, and has also successfully demonstrated the great promise that comes from citizen engagement as a critical element in an MMLAP. However, this chapter also demonstrated the importance of introducing the role of intermediaries (or central nodes), whose role was primarily to mobilise citizens and other stakeholders, but also to provide input to the methodology, follow it while executing the activities, and then aggregate and synthesise the results. In the networks analysed in the previous section, the project partners took the role of intermediaries, and were also ultimately responsible of making sense of all the results generated through the MMLAP activities. The network analysis approach further revealed that such involvement of project partners is in fact necessary to position lay citizens at equal footing with "traditional" stakeholders, who often have well-established collaboration mechanisms. MMLAPs thus benefit current approaches to policy-making, but at the same time introduce an additional system loop by integrating and giving shape to previously "un-connected" citizens, who act as both "ideators" and "validators" of proposed solutions.

Since MMLAPs are also by definition a transnational effort, the question remains whether the networks they help to produce can actually be considered in an integrative way across country boundaries. Though in this chapter a conclusive answer is hardly possible, we are more inclined to agree that it is precisely the MMLAP design that makes a cross-border network possible, thanks to the cooperation within the same kind of activities, driven by the same methods, of partners from different countries, including across sectors. Such an exchange might additionally enhance the learning that results from the MMLAPs execution.

References

Benz, A. and Fürst, D. (2002) Policy learning in regional networks. *European Urban and Regional Studies* 9 (1): 21-35.

Borgatti, S. P. and Everett, M. G. (2006) A graph-theoretic perspective on centrality. *Social Networks* 28 (4): 466-484.

Brown, V. A., Deane, P. M., Harris, J. A., Russel, J. Y. (2010) 'Towards a Just and Sustainable Future,' in Brown, V., Harris, J. A., Russel, J. Y. (eds) *Tackling Wicked Problems Through the Transdisciplinary Imagination.* London: Earthscan.

Hafner-Burton, E. M. and Montgomery, A. H. (2010) *Centrality in Politics: How Networks Confer Power.* Paper 9, http://opensiuc.lib.siu.edu/pnconfs_2010/9.

Heikkila, T. and Gerlak, A. K. (2013) Building a conceptual approach to collective learning: Lessons for public policy scholars. *Policy Studies Journal* 41 (3): 484-512.

Knoke, D. and Yang, S. (2008) *Social Network Analysis.* Thousand Oaks, CA: Sage.

Kramer, A. and Pahl-Wostl, C. (2014) The global policy network behind integrated water resources management: Is it an effective norm diffusor? *Ecology and Society* 19 (4): 11.

Popper, R., Velasco, G. and Popper, M. (2017) *CASI-F: Common Framework for the Assessment and Management of Sustainable Innovation*, CASI project report. Deliverable 6.2.

Rantala, S. (2012) *Knowledge and Brokerage in REDD+ Policy Making: A Policy Networks Analysis of the Case of Tanzania.* Cambridge, MA: Kennedy School of Government, Harvard University.

Rotmans, J. and Loorbach, D. (2009) Complexity and transition management. *Journal of Industrial Ecology* 13 (2): 184-196.

Scholz, R. W. *et al.* (2000) Transdisciplinarity in groundwater management — towards mutual learning of science and society. *Water, Air, & Soil Pollution* 123 (1): 477-487.

Scott, J. (2012) *Social Network Analysis.* Thousand Oaks, CA: Sage.

United Nations (1987) *Our Common Future - Brundtland Report.* Oxford: Oxford University Press.

CHAPTER IV
More of the same or something different? – Arguing for disruptive public engagement in research and innovation policy

Kaisa Matschoss, University of Helsinki
Petteri Repo, University of Helsinki

Abstract

This paper argues that citizens provide opportunities for disruption in the development of research and innovation priorities based on an engagement process executed in context of a European CASI project. The project provided 245 citizens in 12 European countries the possibility to express their visions on sustainable futures, which were elaborated as research and innovation priorities by 22 experts. The results of this process indicate that listening to citizens produces different kinds of ideas than listening to experts only. We found that citizens are more concerned with societal and local issues than the experts, who have a more technology driven approach. We argue that if the aim is to gain novel and potentially disruptive ideas, turn to the citizens.

Introduction

In a world seeking transition towards sustainability, innovations can provide new solutions to challenging societal problems. At the same time, we need to guide the transition so that the process of change indeed progresses while not turning into a drift with unexpected and possibly unwanted consequences. The old recipes for agenda setting and policy-making, nevertheless, seem to lead to conventional and conservative strategies rather than towards radical innovations that could disrupt the old system and create something novel.

Public engagement has been in the centre of the European science policy through its comprehensive Responsible Research and Innovation (RRI) approach (European Commission, 2013). RRI is hoped to provide solutions to the challenges that the society is confronted with today (Von Schomberg, 2013). It is based on the principle of accounting for the impacts of research and innovation activities on the environment and society (Von Schomberg, 2011). In this context, it is a guiding principle of RRI to increase the legitimacy and acceptance of research policy among the citizens through public engagement.

Maybe even more importantly, though, we argue that a considerable added value of engaging the public in research policy may emerge through the disruptive features of public engagement alongside the well-known targets of societal inclusiveness and technological acceptance. Disruption through public engagement may then lead to emergence or transformation of a new field (Fligstein, 2013), bring about innovations that change the course of market developments (Christensen, 1997), or simply bring forward a different kind of change and diversity (Kahane *et al.*, 2013). In addition to improved quality of priorities for the future, engagement may thus result in deliberation of a wider range of arguments and plural rationalities. Against this background, disruptive public engagement could even contribute to developing lead markets for innovations that address pressing societal needs (European Commission, 2013).

This paper examines the disruptive features of public engagement in the development of priorities for research and development agendas. It reviews how the process of public engagement and the outcomes of such a process may be disruptive as observed in the CASI project. This paper is based on empirical research data collected in citizen engagement activities in 12 European countries.

In the next section, we discuss key theoretical approaches of disruptive innovation that relate to public engagement. Then we discuss the character and features of a multi-step engagement process in which both citizens and experts were involved with an aim to create priorities for European research programmes. We then carry out a comparative analysis of citizen and expert priorities, arguing that citizens and experts indeed maintain differing priorities. We discuss our findings and conclude with the reflections of the results in terms of disruptive potential in engaging citizens.

Disruption through public engagement

Disruptive innovation is typically considered in terms of technology and business models (Christensen, 1997; Markides, 2006). Innovation then transforms and potentially destroys existing markets and creates new ones by finding new solutions to problems (Hauser *et al.*, 2006). In order to be qualified disruptive, respective innovations need to challenge existing business practices, and provide trajectories that challenge the sustaining trajectories of incumbents (Christensen *et al.*, 2015). In the realm of setting priorities for research and innovation agendas, disruption relates to contributing with something that is different from the priorities of incumbent experts, stakeholders and vested interests. Such disruption can be considered particularly useful when research and innovation needs to reformulate its priorities.

The novel added value of involving the public in research and innovation priority setting may indeed take place through the disruptive features of public engagement rather than through inclusiveness, increased legitimacy and acceptance. The latter are all respected targets of public engagement, but do not necessarily target disruptive or radical change. Yet in order to answer to the pressing sustainability needs of today, rapid and significant change is needed. Such change takes place especially when a new field is formed or at the transformation of an old field (Fligstein, 2013), and public engagement may strengthen disruption and lead to emergence or transformation of a new field. Transformation in the Danish energy sector exemplifies the potential of citizen power very well. The conflict between the visions of the citizen-based anti-nuclear movement and the visions of the government and power utilities lead to a thorough development of the Danish power sector as incumbent energy producers switched to new production methods and new entrants further transformed the field making Denmark a super power of wind power (Jørgensen, 2012).

Innovation research has well recognised the tendency of established actors to reinforce the existing systems for many reasons. The old structures and networks can thus be a barrier of disruptive innovations to emerge as innovations always induce change (Bessant, 2013). The managers of incumbent firms are focused in meeting the needs of current customers and therefore might not see the benefits of innovations when they would meet the needs of new customers (Christensen, 1997). Citizen engagement is valuable as they are prone to challenge incumbent stakeholder arrangements, goals and expertise. Public engagement thereby bears the potential to bring about innovations that do not seem useful today but could turn out to be so in the future.

In the context of disruptive innovation, its consequences to society are of great interest. As Bessant (2013) reminds us: innovation is not always a good thing. There might be unanticipated and negative consequences emerging "downstream" (Bessant, 2013, 41). If disruptive innovations are initiated and arise from the downstream, that is, from the general public, the risks relating to negative consequences to the society can be alleviated in a new way. Actually, public engagement in upstream policy-making has been called for in the literature of responsible innovation (e.g. Rask et al, 2016; Sykes and Macnaghten, 2013), because it has been recognised that co-production of policy choices with the public enables the embodiment of social knowledge, values, and meanings from very diverse point of views (Sykes and Macnaghten, 2013). Public engagement can, thus, support democratic developments and transnational decision making though inclusive agendas (Dahl, 1994). In addition to supporting democratic developments, public engagement can be a way to "catalyse and provoke wider spontaneous political activity" (Stirling 2007, 293).

Public engagement is called for when policy targets disruption, because public engagement can support in bringing forward change and diversity (Kahane *et al.*, 2013). Engagement thereby contributes to deliberation of a wide range of arguments and plural rationalities. Public engagement can increase diversity of views and legitimacy of policies and due to citizens' linking policy to underlying values, the engagement processes can bring into light thus far hidden values of the society. Therefore, citizen involvement processes may help to unravel the direction where the public could be guided if addressed with collective reasoning because citizens may be open to changing position based on learning (Kahane *et al.*, 2013). Public engagement, thereby, benefits from interaction with expert knowledge, which makes potential disruption better conscious of existing fields.

In the next sections, we look at an actual citizen engagement process that focused on bringing into light citizens' priorities for research and innovation that contribute to desirable and sustainable futures. We

first describe the engagement activity and the kinds of empirical data that were created in the process. We then review how citizen involvement bears the potential of creating disruption.

Engaging citizens: From visions to priorities

Citizens and experts were engaged in a three-step process in the CASI project. In all 12 countries, the principle of citizens' selection was to engage many kinds of people. It did not strive for representation in terms of population, but to involve as various backgrounds as possible in terms of age, gender, living environment (urban/rural), education, profession or the sector of employment. The first workshops were organised in all 12 countries in 2015. The involved citizens were asked to envision sustainable futures 30 years from now. The outcome of these workshops were 50 visions. In the second stage of the process, sustainability and innovation experts used citizens' visions to formulate research priorities. The participating experts were stakeholders and policy-makers, scientists and policy analysts, representing the private sector, non-governmental organisations and governmental bodies. In the final stage of the engagement process, the same citizens that took part in the first citizen vision workshops were invited to another workshop to rank the priorities developed by the experts (for more details see Kaarakainen *et al.*, 2015; Matschoss *et al.*, 2015; Repo *et al.*, 2015). The engagement process was developed in a European project called CIVISTI (Andersen and Jacobi, 2011; Rask and Damianova, 2009) and has since been used in another project called CIMULACT.

In order to support the experts in the formulation of research priorities based on the citizen visions, the visions were presented to them clustered in topics. To cluster the visions, we used a statistical topic cloud tool: TIB software, which is now available online at https://research.kapiche.com. This tool applies statistical analysis to merge words into topics and to express relationships between topics. The visions were prepared for clustering by removing the instructive headings of the structured template and stop words so that they would not affect the results. The idea of this approach is to base the analysis on data rather than apply any predefined concepts or categories to the analysis.

The experts in the second workshop developed tentative research priorities for all citizen visions, altogether 49[5] tentative priorities. Then they voted for the most important research priorities and thus performed a selection of priorities. This procedure provided a first evaluation of what was considered interesting and important by the experts. Therefore, from 49 tentative research priorities based on the initial visions, 27 priorities were selected and ranked according to perceived importance. The second citizen workshops were organised in the partner countries in autumn. Citizens also assessed and ranked the 27 fully conceptualised priorities, producing lists of Top-10 research priorities for the 12 European countries participating as partners in CASI.

In the next section of this paper, we compare the visions that the experts selected to be further elaborated to priorities in order to review expert preferences across topics. We show that what citizens and experts value is different and therefore citizens' views could bring something new to the mainstream incumbent policy-making. We also compare the differences in the Top-10 lists of the experts and the citizens against this aim.

Where is the disruption?

In the first stage of our research, we studied what kinds of citizen visions experts selected for elaboration to research and innovation priorities. In the first column of Table 2, we list names of the categories of visions and, in the second, the numbers of research priorities that were produced based on the citizen visions divided in a topic category. The citizen visions fall into eight categories: social development and people, values and politics, change for the future, living and spaces, system resources, urban life, energy and production, as well as local needs and support. The third column of Table 2 presents the number of research priorities selected for elaboration and finalisation in each category. The fourth column presents the share of rejected priorities in each topic.

---

[5]   Although there were 50 initial visions, two were joined together in the expert workshop, which lead to the design of 49 tentative research priorities.

Table 2: Number of draft and elaborated research priorities

Category of visions	Draft research priorities (one per vision)	Elaborated research priorities	Share of rejected priorities %
Social development and people	10	2	80
Values and politics	7	3	57
Change for the future	7	4	43
Living and spaces	5	3	40
System resources	8	5	37
Urban life	4	3	25
Energy and production	6	5	17
Local needs and support	2	2	0
Total	**49**	**27**	**45**

The results show that experts rejected 80 per cent of the research priorities that were based on citizen visions related to social development and 57 per cent on values and politics although these topics included a considerable number of originating visions. In contrast, technologically focused visions on energy and production, and system resources had a much lower rejection percentage (17 and 37 per cent, respectively) and were most often selected also in absolute numbers.

The figures indicate that experts can readily overlook issues relevant to citizens. As an example of rejected research priorities, Table 3 presents the citizen visions and formulated research priorities within the topic of 'social development and people' (for more information on the complete list of visions, please refer to Kaarakainen *et al.*, 2015).

Table 3 shows that the only citizen visions relating to societal development and people that were fully developed to research priorities by experts focused on food industry and sustainable economics. Other visions that did not progress to elaborated research priorities related to social responsibility, tolerance, humanity, equality, values, empathy, and happiness. If disruption in innovation and sustainability is sought for, these targets would be useful to pursue.

Table 3: Visions and research priorities in the topic 'social development and people'

Name of the vision	Short description of the vision	Name of research priority
Rejected		
Eco2 Social Industry in 2050	A socially responsible, eco-friendly, innovative and efficient industry.	History & transformations of medical models
Facing immigration of nations	The vision describes the integration of immigrants in society. It addresses the issues of tolerance, respect, co-existence, acceptance of diversity and adaptation. It touches the solving of problems and appeals to institutions to be more active in seeking more appropriate solutions.	Researching migrant diversity. Research of the diversity of immigrants' lives

Name of the vision	Short description of the vision	Name of research priority
Homo Faber	Promotion of a different scale of values, focusing on human beings as individuals with collective needs, undertaking a role of drivers of change, by excluding the support of technologies in this case. Indeed, nowadays everything is driven by the profit (or by the power that could be interpreted as a synonym to the profit) and an individual vision and perspective, rather than collective, while individuals are not considered as actors responsible for actions that may be of a benefit to the entire community, but rather concentrate on the personal gains instead.	Prototyping new world
Human world	The world in which the value of the person is who he/she is, not what he/she possess. World in which money is the means, not the objective itself. World where money is gained through good life, life in which work is a value. World in which human and nature are the subject, not the object.	Human world
Living community	Equality as a common denominator for all citizens, enhancing free access to education, health, justice and opportunities.	Living in community
Societal reset	Inspired by the fear of overgrowing and unsustainable moral crisis in Europe. Back to nature and traditional values; move away from individualism. People consider planet as a social heritage and contribute to a common good of the entire planet and its population.	Societal reset
Society of understanding (empathic)	Vision is about the open civil society, where we respect our differences. They are our assets, which can inspire us, not threats. Different stakeholders collaborate and create efficient partnerships (e.g. NGOs with the health sector). The important element of the vision is high level of public participation – leaving out the NIMB approach and carrying for the common welfare. The legislation is pro-entrepreneurial and oriented on citizens' welfare.	Society of understanding
The happy life. Healthy and contending life as the driver of a holistically sustainable development	Consuming, owning, climbing social ladders, or craving for recognition is not what makes us happy, but rather a healthy and contending life. We realise the world we live in as a holistic system evenly containing the good and the bad. Success means living a life in balance between the two poles and not the accumulation and exploitation of resources.	Happy life
Not rejected		
Food for all	The vision is to have sufficient nutritious, culturally appropriate and acceptable food for an active and healthy life. This includes access to food for all including land, raw materials, transport, markets and finance as locally appropriate. This will be done by tackling waste at all parts in the supply chain; access to knowledge of food, to grow, cook, store, eat; encourage environmentally sensitive production and reduce food miles and encourage local produce.	A new European food culture

Name of the vision	Short description of the vision	Name of research priority
Recognition, rethinking and responsible governance / action	It is necessary to take over responsibility for a sustainable European development as a paradigm for the global world in 30 to 40 years ahead. Objectives are a socially balanced society and the protection of the quality of life for future generations. Focal points are the social aspects, not material facets. The benefit of this vision is a better life for all the people.	Sustainable economics

Indeed, it seems that social issues bear the seed of disruptiveness in them, and citizens provide novel ideas that challenge established stakeholders in their viewpoints and expertise. When we further compare the Top-10 listings of research priorities as ranked by the experts and citizens, we notice that only two priorities appear in both lists (Table 4). This accentuates that experts and citizens in general possess very different priorities.

Table 4: Top-10 research priorities of European citizens and experts

№	Experts	Initial vision category	European citizens	Initial vision category
1	Improvement of European electricity transmission to increase renewable energy production	Energy and production	Supporting local/regional agricultural production, distribution and consumption system	Energy and production
2	Research on business models and changing institutions related to sustainable energy	Energy and production	Holistic education for a sustainable future	Change for the future
3	Sustainable living environment	Values and politics	Supporting people to become producers of renewable energy	Energy and production
4	Holistic education for a sustainable future	Change for the future	Sustainable construction of buildings	Local needs and support
5	A new European food culture	Social development and culture	Sustainable transformation of existing traffic infrastructure in cities	Urban life
6	Access to natural resources as a human right	System resources	New working models – new economic models	Values and politics
7	Co-developing green technology	System resources	Innovating agriculture: the sustainability option	System re-sources

№	Experts	Initial vision category	European citizens	Initial vision category
8	Sustainable economics	Social development and culture	More green in cities	Living and spaces
9	Unified ecological grading system	Change for the future	Understanding and implementing sustainable electronics	System resources
10	Sustainable transformation of existing traffic infrastructure in cities	Urban life	Fair and participatory access to limited resources	System resources

Only two priorities appear on the Top-10 lists for experts and citizens: 'Sustainable transformation of existing traffic infrastructure in cities' and 'Holistic education for a sustainable future'. Both also rank higher in the citizen list than in the expert lists. In the Top-10 list of experts, the topics belong to the vision categories 'Energy and production' (2), 'Values and politics' (1), 'Change for the future' (2), 'Social development and culture' (2), 'System resources' (2) and 'Urban life' (1). Whereas the priorities in the European citizen Top-10 list belong to the categories 'Energy and production' (2), 'Change for the future' (1), 'Local needs and support' (1), 'Urban life' (1), 'Values and politics' (1), 'System resources' (3) and 'Living and spaces' (1). These results, again, show that experts and citizens rank priorities differently. This implies that if policymakers would truly wish to gain novel and potentially disruptive ideas, they should turn to the citizens instead of experts.

If disruption contributed by citizens is sought for, the highest ranked citizen priority 'Supporting local/regional agricultural production, distribution and consumption' merits particular attention. It can, indeed, be considered disruptive in the sense that it challenges established European and global agricultural markets. Similarly, citizens rank high the priority of 'Supporting people to become producers of renewable energy'. This priority can be considered systemically disruptive in the sense that its expert counterpart 'Improvement of European electricity transmission to increase renewable energy' takes a systematically very different and sustaining-oriented approach to renewable energy. 'Holistic education for a sustainable future' appears non-disruptive at first sight, albeit the different overall priority rankings between experts and citizens imply that the intended education could also be different.

Discussion and conclusions

This paper has argued that citizens provide opportunities for disruption in the development of research and innovation priorities. The CASI citizen engagement process introduced disruption priority setting by providing citizens the possibility to express their views of a sustainable future. Results indicate that listening to citizens produces different kinds of ideas than if we listen only to experts. We have witnessed that, in general, citizens were more concerned with societal issues than the experts. They also assessed research and innovation priorities differently.

Engaging citizens may thus challenge the established field (Fligstein, 2013) of research and innovation priority setting as well as provide insights that could potentially change the course of markets from incumbents' sustaining trajectories to disruptive trajectories (Christensen *et al.*, 2015). Citizens also give their flavour on desired change and highlight diversity in policy-making (Kahane *et al.*, 2013). Additionally, involving citizens brings along the traditional virtues of public engagement such as societal inclusiveness and technological acceptance.

Citizen involvement can increase public legitimacy and diversity but more importantly, because citizens tend to link policy to underlying values, the engagement processes can bring into light so far invisible values of the society. The Top-10 lists presented in the previous section basically represent the differing values of citizens and experts. Understanding the linkages of policies and the citizens' values may enable

the creation of policies that have more efficient impacts on the society and support the disruption. We also argue that better knowing the underlying values of citizens, the policymakers may have more courage to push forward such policy measures that are opposed by the incumbent stakeholders but supported by the citizens.

There are several practical insights on disruption to be learned from the citizen and expert engagement process as it was applied in the CASI project. First of all, it is beneficial to engage citizens for disruption i.e. acquiring different priorities than those of incumbent experts, stakeholders and vested interests. Secondly, disruption may be achieved by highlighting social topics and values on the research and innovation agenda. In effect, calls for including them on the agenda represent themselves a critique of the current agenda. Thirdly, priorities ranked highly by citizens may themselves be very disruptive, and are perhaps therefore not so highly regarded by incumbent interests.

Political populism is currently seen to challenge public engagement in the sense that it is questioned if the populus should be listened to as before. Critics say that populism indicates that public engagement is not trustworthy as a source of relevant information while proponents argue for more or better engagement. The relationship between public engagement and populism changes when looked at from the perspective of disruption. Current populism strives for disruption and public engagement will lose initiative unless it forms a stance on disruption. As this paper has shown, public engagement can very well adapt to address and foster disruption. Many societies are now facing a competition on who is leading disruption – political populists or advocates of public engagement.

At a more practical policy level, policy systems should become more responsive to disruption generated by citizens. Institutional embedding in the form of support for implementation of public engagement merits further attention. Policy systems also need to be able to digest the outcomes of public engagement without losing out on their disruptive potential. Indeed, in an open world the accountability of policy systems may indeed be determined by how well they respond to citizen disruption rather than how well they serve incumbents' interests.

We would like to conclude by citing Andy Stirling (2007: 293) "The shape of our possible futures is a matter of active social choice. What remains to be seen is whether we can develop the political maturity to recognize this and ensure that these futures are not only more sustainable and precautionary – but more socially robust."

References

Andersen, I. and Jacobi, A. (2011) CIVISTI - *Deliverable 1.3: Civisti Methodology Manual. CIVISTI project.* See www.civisti.org.

Bessant, J. (2013) 'Innovation in the Twenty-First Century,' in Owen, R., Bessant, J. and Heintz, M. (eds) *Responsible Innovation. Managing the Responsible Emergence of Science and Innovation in Society.* Wiley.

Christensen, C. M., Raynor, M. E. and McDonald, R. (2015) Disruptive Innovation. *Harvard Business Review* 93 (12): 44-53.

Christensen, C. (1997) *The Innovator's Dilemma.* Cambridge, MA: Harvard Business School Press.

Dahl, R. A. (1994) A democratic dilemma: System effectiveness versus citizen participation. *Political Science Quarterly* 109 (1): 23-34.

European Commission (2013) *Options for Strengthening Responsible Research and Innovation* – eport of the Expert Group on the State of Art in Europe on Responsible Research and Innovation (PDF). doi:10.2777/46253. Accessed 12 February 2017 at http://ec.europa.eu/research/science-society/document_library/pdf_06/options-for-strengthening_en.pdf.

Fligstein, N. (2013) Understanding stability and change in fields. *Research in Organizational Behavior* 33: 39-51.

Hauser, J., Tellis, G. J. and Griffin, A. (2006) Research on innovation: A review and agenda for marketing science. *Marketing Science* 25 (6): 687-717.

Jørgensen, U. (2012) Mapping and navigating transitions — The multi-level perspective compared with arenas of development. *Research Policy* 41: 996-1010.

Kaarakainen, M., Repo, P., Matschoss, K., Bedsted, B., Rask, M. and Damianova, Z. (2015) 50 *Citizen Visions on Sustainable Futures.* CASI project. Available at http://www.casi2020.eu/library/#d7176.

Kahane, D., Loptson, K., Herriman, J. and Hardy, M. (2013) Stakeholder and citizen roles in public deliberation. *Journal of Public Deliberation* 9 (2).

Markides, C. (2006) Disruptive innovation: In need of better theory. *Journal of Product Innovation Management* 23 (1): 19-25.

Matschoss, K., Repo, P., Kaarakainen, M., Kloppenborg, E., Ibsen-Jensen, J. and Kyhn, B. (2015) *Citizen Assessment of Priorities for European Research.* A report of the CASI-project. Accessed 1.3.2017 at http://www.casi2020.eu/library/#d7200.

Owen, R., Macnaghten, P.M. and Stilgoe, J. (2012) Responsible Research and Innovation: From Science in Society to Science for Society, with Society. *Science and Public Policy* 39 (6): 751–760.

Rask, M. and Damianova, Z. (2009) *Citizen Visions – Preliminary Content Report.* CIVISTI project. http://www.civisti.org/files/images/Preliminary_content_analysis_FINAL_CORR.pdf

Rask, M., Mačiukaitė-Žvinienė, S., Tauginienė, L., Dikčius, V., Matschoss, K., Aarrevaara, T. and d'Andrea, L. (2016) *Innovative Public Engagement. A Conceptual Model of Public Engagement in Dynamic and Responsible Governance of Research and Innovation.* ISBN 978-951-51-2267-4. Accessed 9.3.2017 at http://www.pe2020.eu

Repo, P., Kaarakainen, M. and Matschoss, K. (2015) *European Research Priorities Based on Citizen Visions.* A report from the CASI expert workshop in Copenhagen 8.9.2015, Deliverable 3.3, Task 3.4. Available at: http://www.casi2020.eu/library/#d6635

Von Schomberg, R. (2011) *Towards Responsible Research and Innovation in the Information and Communication Technologies and Security Technologies Fields.* Accessed 9 March 2017 at http://ec.europa.eu/research/science-society/document_library/pdf_06/mep-rapport-2011_en.pdf

Von Schomberg, R. (2013) 'A Vision of Responsible Research and Innovation,' in Owen, R., Bessant, J. and Heintz, M. (eds) *Responsible Innovation. Managing the Responsible Emergence of Science and Innovation in Society.* Wiley.

Stirling, A. (2007) Deliberate futures: Precaution and progress in social choice of sustainable technology. *Sustainable Development* 15 (5): 286–295.

Sykes, K. and Macnaghten, P. (2013) 'Responsible Innovation – Opening Up Dialogue and Debate,' in Owen, R., Bessant, J. and Heintz, M. (eds) *Responsible Innovation. Managing the Responsible Emergence of Science and Innovation in Society.* Wiley.

CHAPTER V
CASI pilot implementations – an insight from Bulgarian innovative companies

Marta Pinto, Inova+
Caterina Azevedo, Inova+
Maria Alexandrova, Cleantech Bulgaria

Abstract

This chapter focuses on the analysis of the feedback provided by a specific type of stakeholders involved in the management of sustainable innovations – the business stakeholders – who have participated in the CASI pilot implementation and developed a Business Action Roadmap. In Bulgaria, the CASI-F methodology was piloted with four sustainable innovation initiatives (4 innovators) – 3 established companies and one start-up went through the entire process. Once this task was concluded, the method was further suggested for use in the Climate-KIC Bulgaria acceleration programme where seven Bulgarian start-up teams have implemented the tasks foreseen in their Action Roadmap. The Bulgarian innovators' experience is presented in this chapter.

Introduction

Despite the economic and political instability, Bulgaria has been gaining reputation as a European start-up hub, attracting the attention of venture capital and seed funds from across European investors. The boom of IT outsourcing, hardware and software solutions, dating back to 2012, opened the eyes of many international companies, turning Bulgaria into a vibrant ecosystem and an excellent source of bright minds. The natural consequence was a rapid activation of entrepreneurship, as many professionals with years of corporate experience started their own ventures, motivated to reach international recognition and investment.

However, there are still many problems and challenges in the country. Funding, for example, is just one side of the problem as funding innovation-related companies or start-ups is considered to be risky. Moreover, scale up and later stage support is immature and international investors entering the Bulgarian market are looking for export-oriented ventures with high growth rates or companies that occupy a specific niche. The overall innovation performance needs to make the turn towards green. But as the Innovation.BG 2016 report (ARC Fund, 2016) states "Bulgaria needs to change the narrative of its green policies from confronting green investments with social hardships towards emphasising their common effects in the long term. Putting Bulgaria on a sustainable green path will very much depend on the success of establishing a vibrant local green business community integrated in the international value-added chains."

This logically unfolds the other challenges that the Bulgarian innovation system is facing – the lack of sufficient support for fostering business skills.

Currently, seed funds such as Eleven and LAUNCHub, venture funds like NEVEQ and accelerator programmes like Start it Smart and the Climate-KIC Accelerator operated locally by Cleantech Bulgaria keep the businesses growing. Thanks to these, some start-ups have witnessed this swift scalability of the ecosystem as a sign of "a bubble waiting to burst", but the truth is that Bulgaria is only gaining speed. Back in 2013, Bulgaria was named one of the top 3 destinations in Europe for start-ups, with over 150 supported ventures to date. Certainly, this was mostly due to the direct involvement of the European Investment Fund (EIF) and its injection of more than €21m, as due to the support of other European Programmes, such as the European Commission's Start-up[6] and Scale-up Initiative[7], which act as vehicles that foster entrepreneurial growth in tech and software solutions, innovations and energy efficiency, allowing innovators, entrepreneurs and start-uppers more opportunities to become world-leading companies.

[6]   https://ec.europa.eu/digital-single-market/en/startup-europe

[7]   https://ec.europa.eu/digital-single-market/en/news/new-initiative-startups-start-and-scale-europe

CASI helps start-ups to deliver their innovation

CASI was one of the European initiatives that proved to have the potential to help start-ups deliver their full innovation. As part of the growing strategy of start-ups lies in the improvement of the management and support of a given innovation, CASI was first presented to three Bulgarian innovative companies and one start-up. Then, following the positive response, the methodology was introduced to the start-ups teams of the Climate-KIC Accelerator Bulgaria, managed by Cleantech Bulgaria in partnership with Climate-KIC. Seven teams used CASI, and in particular the CASI Matrix and Roadmap methodology as the ideal support (through its toolkit of resources) to address the deficit of certain entrepreneurial skills, to provide a tool for analysis and reinforcement of managerial practices, and to enrich the practitioners with the vast benchmarking and inspirational opportunity that CASI mapping experience brings in.

During the pilot implementation of the CASI Methodology with the three Bulgarian innovation cases, and later with the eight Bulgarian start-ups, it was very interesting to find out that the Action Plans they have developed have been particularly useful for group processes, design work and for improving the impact of their innovations. Moreover, this group has also highlighted the fact that CASI features a sort of a structure that introduces the innovators to analytical and planning processes.

This observation was also confirmed later when Cleantech Bulgaria introduced CASI-F methodology to a group of seven Bulgarian start-ups, during its acceleration programme. The feedback from these start-ups pointed out the usefulness of CASI in building a more comprehensive picture of their business models as it enabled them to identify critical issues affecting the development of their business (by engaging into in-depth analysis of the barriers, drivers, opportunities and threats), followed by a prioritisation of such critical issues (by analysing their importance, feasibility and impact), which has led to the development of their own action roadmap, a plan of short, medium and long-term actions and suggestions to manage and overcome such critical issues.

CASI Action Roadmaps

The main objective of the CASI pilot implementation was to invite the quadruple helix stakeholders of sustainable innovation (SI)[8] to develop an Action Roadmap for their innovations using the Framework for Assessment and Management of Sustainable Innovation (CASI-F) Methodology (see Popper *et al.*, 2017).

In the context of the CASI project, actions support the management of sustainable innovation and are created based on three management levels (strategic, programming and operational management level) and four stakeholder perspectives (governmental, business, civil society and research & education). Following a prioritisation and selection of one or more actions addressing identified with the innovators critical issues (barriers, drivers, opportunities and threats) affecting the success of the innovation, 43 innovators were invited to create more detailed Action Roadmaps, fleshing out the selected actions.

An action roadmap is a plan that focuses particularly on the implementation of one or several actions from a management perspective considering the following dimensions: context, people, process and impact. It identifies ten different sub-tasks that together cover ten key aspects of SI management (see Popper *et al.*, 2016) and assigns an appropriate timeframe for the implementation for each of these tasks (i.e. short-, medium- and long-term). The ultimate goal of this plan is to allow the innovator to gain tailored advice on how to address critical issues by implementing specific actions in a structured and more suitable manner that considers important management dimensions and aspects.

During the CASI pilot implementation these 43 innovators were involved in the creation of various action roadmaps during one-to-one sessions with CASI partners. Specific feedback was collected during this process and the results were analysed to assess different types of data including the distribution of chosen actions per type of stakeholder, evaluation of the experience when using the Action Roadmap and implementation of the various CASI tools, among others.

The analysis section below will start by profiling the Business Stakeholders based on the analysis of the ***Business Action Roadmaps***, followed by a brief analysis of the opinions collected from the representatives

---

[8]   Government, Business, Civil Society and Research and Education

of the 7 Bulgarian start-up companies, to understand how CASI Action Roadmaps have proven to be particularly useful for group processes, design work and for improving the innovation impact.

Analysis

As previously mentioned, CASI tools have been developed for the quadruple helix actors of SI to support them in the management of critical issues that could potentially affect their innovations. These stakeholders include government, business, civil society, and research and education actors.

During the pilot implementation, 43 innovators have shared their innovation actions with CASI team and have co-created tailored plans, with clearly defined tasks and precise timeframes – the **Action Roadmaps**. To allow a more detailed perspective on the management level required for the accomplishment of each action of this plan, these were clustered into three groups: strategic and conceptual management level – focused on ideas, sustainable demand, sustainable challenges, systematic change; tactical and programming management level – focused on intervention concepts, methods, structures, programmes and other funding mechanisms; and operational management level – focused on implementation, process barriers, cycles, role of stakeholders.

Considering the **Action Roadmaps** produced, particularly those that focus on business-actions (for example M Cube - Fine tuning of the business model or AHA Car: Refining the unique value proposition for the corporate customer – see Anttila, 2016), it becomes clear that the innovators have put significant emphasis on tasks which proposed enhanced internal development practices (including personnel) and/ or the creation, modification, development and diversification of new business models as means to achieve success. For example, whereas most Action Roadmaps not related with Business have identified more obvious tasks, including employee training and fostering their engagement in the workplace, the majority of the **Business Action Roadmaps** have proposed more versatile types of employee-related tasks, including profiling employees and their skills, transforming the working culture, creating incentive system and finding new ways for distributing workload.

Another key point highlighted in **Business Action Roadmaps** was the high number of proposed tasks related to identifying, implementing and monitoring of evaluation systems for multiple purposes, including management commitment, employee engagement, business opportunities and workload. Similarly, there were also mentions of different business-related certificates and of metrics that define successful performance and business attainment.

Business Action Roadmaps have also highlighted the importance of engaging and managing different groups of stakeholders, through crowdsourcing, workshops, events and competitions. Particularly at operational management level, several Action Roadmaps have even proposed a sort of *low-barrier* ways to enhance collaboration with and within various stakeholder groups, through training, ambassador programmes and campaigning. Moreover, it was also interesting to perceive that at operational management level, **Business Action Roadmaps** were the only type of plan which considered the importance of infrastructures fit for different purposes, including information services, training and digital work.

The previous paragraphs have summarised some of the tasks proposed in the **Business Action Roadmaps**, which allows considering that the type of stakeholder in question – Business-related – is more focused and concerned on the *how* – how to implement specific tasks that help overcome identified challenges, rather than the what, meaning the further identification of such challenges. In other words, whereas other types of Action Roadmaps were focused on highlighting their impact and objectives, Business Action Roadmaps were focused on proposing and detailing concrete steps and action-plans.

Considering the type of stakeholders represented by the seven Bulgarian start-ups – *the Business stakeholders* – it was very interesting to find out that the **Action Roadmaps** the innovators have developed were particularly useful for group processes, design work and for improving the impact of their innovations. Moreover, this group has also highlighted the fact that CASI features a sort of a structure that introduces the innovators to analytical and planning processes, as it has proved to be a "very good tool to get an overview of the project Enerwall to plan, categorise, estimate and organise work that needs to be done to create a new project for implementation of sustainable innovation" – Mr. Ilian

Gechkov, founder of Enerwall.[9] Moreover, CASI and particularly the Action Roadmaps have also proved to be an "effective tool for reflection and monitoring practices showing diverse dimensions for creating connections and tools that build social participation between local society and people responsible for creating the environment open for participation"– Mr. Stanislav Yordanov, founder of Synec platform.[10]

Concluding remarks

Six months after the implementation of the pilots by the leading four innovation cases, the innovators were contacted to comment on their experience in using and implementing the Action Roadmaps. In addition, the start-up teams (in their 12 weeks of acceleration) who developed the roadmaps for their business projects, with the help of respective CASI team, were closely followed as they validated their approach in the real-life environment.

From the main findings collected based on the experience of the Bulgarian innovators, it was quite clear that CASI-F could be useful if one additional dimension was considered, namely to review how other stakeholder groups perceive the stakeholder's role in a certain process of innovation management.

As CASI-F challenges any user or innovator to consider and/or review his/her relations and the possible impacts on other SI stakeholders of the quadruple helix, it could be quite interesting to break down these interactions to concrete tasks into different management levels with specific timeframes and key management aspects, enhancing the creation of a multi-layered and interconnected picture of any innovation case. As such, CASI-F would enable the user to grasp easily his/her relations and dependencies with the other stakeholders and then allow other stakeholder groups to understand better how their role is perceived in a certain innovation case. This opportunity to "step into the shoes" of a stakeholder could be an added-value particularly to the business type of stakeholder.

As far as the representatives from the Bulgarian innovators are considered, these teams are committed to lessons learnt through mutual learning activities offered by the CASI project and have already planned further actions to work intensively with other business representatives and societal groups to influence the government. Furthermore, the social dimension was highly appreciated and considered in the development process of their sustainable innovation agendas.

References

ARC Fund (2016) *Innovation.BG 2016*. Sofia: Applied Research and Communications Fund
http://www.arcfund.net/arcartShow.php?id=17865

Anttila, V. (2016) *Report on CASI-F Implementation*: CASI Project report. Deliverable 6.1, Task 6.1: Action Roadmaps

European Commission (2017) *Startup Europe web pages: Building an EU Startup Ecosystem of opportunities*,
https://ec.europa.eu/digital-single-market/en/startup-europe-building-ecosystem

European Commission (2016) S*tartup Europe: A new initiative for startups to start and scale up in Europe*,
https://ec.europa.eu/digital-single-market/en/news/new-initiative-startups-start-and-scale-europe

Popper, R., Velasco, G. and Popper, M. (2017) *CASI-F: Common Framework for the Assessment and Management of Sustainable Innovation*, CASI Project Report. Deliverable 6.2.

Popper, R., Velasco, G. and Ravetz, J. (2016) *State-of-the-art of Sustainable Innovation: Climate Action, Environment, Resource Efficiency and Raw Materials. CASI Project Report. Deliverable 2.1*.

---

[9]   Enerwall is a start-up accelerated by Climate-KIC Accelerator Bulgaria in 2016
[10]   Synec Platform is a start-up accelerated by the Climate-KIC Accelerator Bulgaria in 2016

CHAPTER VI
CASI results as a toolkit for its end-users with a focus at the regional perspective: CASI and Co-working spaces

Fernanda Pinto Amorim, Câmara Municipal de Espinho
Vincente Pinto, Câmara Municipal de Espinho

Abstract

Within a framework of CASI project, the Municipality of Espinho, looks at CASI results from the perspective of a training tool that enhances the development strategy for the co-creation space that the municipality intends to establish, and which aims to stimulate an entrepreneurial culture, increase opportunities for networking and knowledge, and contribute to increased economic dynamism of the municipality.

One of the project results that can be highlighted is CASI-F – a tool with a direct impact on co-working spaces – which was conceived as a holistic tool to support future-oriented decision-making at strategic, tactical and operational levels for the quadruple helix stakeholders of sustainable innovation i.e. government, business, civil society and research and education actors.

Introduction

Identified as recognition and economic use of opportunities, entrepreneurship is considered a fundamental element for the economic performance of the regions, with a structural and dynamic role in all economies. Considered as an engine of innovation, competitiveness and growth, entrepreneurship requires the creation of conditions that stimulate the economic development, which in turn generates employment and, consequently, wealth. The **co-creation spaces** of companies in Portugal are the preferred spaces for locating new business initiatives, promoting entrepreneurship, innovation and connecting to knowledge centres.

Co-working concept

The concept of 'co-working' concerns the sharing of workspace by a community of entrepreneurs, 'freelancers' and other self-employed professionals. The purpose of 'co-working' is to monetise a whole set of resources, necessary for the operation of a company or project such as furniture, equipment, services and meeting rooms. In most cases, this concept of shared workspaces allows for a more informal office environment and enhances networking.

Co-creation spaces promote local entrepreneurship. They stimulate the emergence of small and medium-sized enterprise initiatives and foster the creation of conditions for their network development, with the resulting benefits of support platforms provided by public entities.

The concept of 'co-working' was created in 1999 by the American game designer Bernie DeKoven to describe a networked computer system. In 2005 in San Francisco, the term 'co-working' began to be spread by software programmer Brad Neuberg who created a shared space in California where he invited all those who wanted to work alongside him.

In Portugal, Cowork Lisboa was one of the first shared workspaces to be inaugurated in the country in February 2010. In this 'co-work', shared working arrangements are divided in larger and smaller spaces but without borders. All facilities are equipped with Internet, telephone, photocopying devices, water and electricity. Meeting rooms are available from 9 a.m. until 9 p.m. Cleaning services are included as well as spaces to have breakfast or coffee. These services are available to its users for a small payment that can be paid on a daily, weekly or monthly basis.

Framing the co-working spaces in the Europe 2020 strategy

The Europe 2020 strategy sets out the priorities for smart growth (based on an economy grounded on knowledge and innovation), for sustainable growth (capable of promoting a more resource efficient, greener and more competitive economy) and for inclusive growth (with high levels of employment capable of ensuring economic, social and territorial cohesion).

The concept of smart specialisation is pointed out by the European Commission as a reference for the development of a regional strategy, based on the specific resources and assets and relative competitiveness of each region (Foray and Van Ark, 2007; Arancegui *et al.*, 2011; and McCann and Argiles, 2011).

The smart specialisation is based on the basic principle that the innovation and competitiveness strategy of the regions should inevitably be based on their own characteristics and assets. It is for the regions to define their R&D and innovation strategy that concentrates their resources on a limited number of priorities, for which it is possible to achieve a globally competitive critical mass. The strategy should be based on the potential of the regions and on the availability of resources and assets with characteristics of inimitability and non-transference, on which tradable goods and services can be created and competitive advantages built. Such assets may be technological (analytical and synthetic knowledge) or non-technological (e.g. symbolic knowledge and capital).

Knowledge and innovation are the main sources of added value and efficiency, and therefore decisive for the competitiveness of companies in the countries and regions. Innovating means changing and being able to adapt to change, and can take on many different types of innovations, including product, process, market, business model innovations, among many others (Dantas and Bell, 2011).

It implies interaction between the various actors involved in the territory. For innovation to occur, companies must establish relationships of exchange of knowledge and information with other companies or organisations. It is therefore through the establishment of these relationships that innovation systems are created. Freeman (1987) defines a national innovation system as a network of public and private sector institutions, whose activities and interactions initiate, import, modify and diffuse new technologies.

The relevance of universities to the drive for innovation has long been recognised, especially in their role in innovation systems, in their ability to respond and find their place as a key element in the knowledge economy.

Co-working spaces and their importance in the development of a territory

As mentioned above, the attractiveness of investments and the promotion of entrepreneurship and innovation depend decisively on the factors of competitiveness and sustainability placed at their disposal by the territories and their forms of organisation and agglomeration.

Today, the territories and economic activities are completely interdependent. A competitive and sustainable territory promotes and competes for competitive and sustainable activities, and vice versa. The innovation potential and capacity of a territory depends very much on its capacity to allow flows of knowledge between the different interested parties.

In view of the current challenges related to innovation, efficiency and competitiveness, the design of an innovation ecosystem in the form of a co-working space is part of the current regional development strategy, a key element for local development.

The concept of co-working has emerged over a decade ago in the United States as a space for collaborative innovation that has met the needs of many liberal workers. Being a simple and economic solution, it quickly expanded to Europe and the rest of the world, beginning to make an appearance in Portugal as well.

The Cook and Co-working concepts were popularised in 2005-2006 by Brad Neuberg, a young American programmer who rented a space in a San Francisco building called "Hat Factory", opened to the community. In this place, he gathered colleagues who wanted to share ideas and solve the problems of working in isolation and solitude. Several publications attribute the first use of these terms to define

joint activity to Neuberg, but the idea was not entirely ground-breaking, as renting offices for community performance has been done previously. However, this time the idea spread quickly and on a much wider scale. Moreover, the spaces represent an instrument of territorial planning and environmental sustainability, to be inserted according to its characteristics, harmoniously in the territory, both at regional and infra-regional level.

From the infrastructural point of view and the provision of basic services, the formation of spaces for co-creation can enhance access to services and goods related to science and technology. They function as an interface of proximity to the knowledge centres, promote the development of economies generating synergies and critical mass and incubating entrepreneurial activities, including those linked to marketing and promotion. The co-creation spaces usually appear in places associated with urban requalification programmes, namely old industrial buildings, and often assume a thematic character. They are seen as areas generating efficiency gains and competitiveness among the companies installed there. Greater rationality in the use of common infrastructure and access to low-cost infrastructure goods and services (maintenance of building, common green areas, waste collection and treatment, surveillance services, social services, etc.) result in economies of agglomeration. The spaces also provide a favourable context for the recruitment of new investors, the establishment of residential population, with a special focus on young people with high technical and professional qualifications, as well as the activation of new qualified national and international youth.

In short, the co-working spaces aim to support the values promoted by those who developed the concept: collaboration, community, sustainability, openness and accessibility. Co-working spaces act as intermediaries between creative individuals ("underground") and innovative companies ("upperground"), contributing to the interaction between actors placed through the articulation of places, spaces, projects and events. In this sense, one of the main gains of the business installed in a space of Co-working, is precisely the obtained credibility in front of its potential customers, partners and even competitors.

The integrated ecosystem of innovation in the municipality of Espinho

In the ambit of the smart strategy, the municipality of Espinho intends to promote the creation of an ecosystem of innovation. Considering the unique and differentiating resources of the city and its orthogonal net, it is intended to promote "Orthogonal Creativity" of the users of a given space, defined as a process of generation and concretisation of ideas/projects with a strong innovative character. It is a question of placing the individual user at the centre of the innovation process, while relating their needs and ambitions to the local innovation ecosystem.

The innovation ecosystem aims at defining a sustainable business model for Espinho with the following main objectives:

- Including Espinho in the Vanguard Innovations, streamlining the local economic fabric;

- Optimising human, material and financial resources;

- Increasing local synergies among entrepreneurs, the business fabric, universities and the market itself.

To this end, it was proposed to create a support infrastructure with lower licensing rates, in order to increase R&D and facilitate the start-up of universities. This is in articulation with the respective dynamics of the existing ecosystem of innovation in the city, which includes the University of Espinho (in the process of creation), the multimedia centre, industrial park and tourist equipment, and the creation of an integrated model, based on 3 new elements: a space of co-creation and co-work, performative arts and experimentation.

Space for co-creation and co-work

With the creation of this space, the Municipality of Espinho intends to promote the integrated development of the city through a holistic approach, considering the economic and social dimensions from a perspective of co-creation. The launch of collaborative innovation practices, involving companies, institutions of the scientific and technological system (national and international) and users, will foster

an open and balanced innovation process between science-led and user-driven perspectives, combining Science, Technology and Innovation modes with Doing, Using and Interacting (DUI) modes.

The aim is to create guidelines for the implementation of an experimental knowledge-sharing system based on co-creation, co-development and acceleration of innovative products and services. This system is to be oriented towards interdisciplinary work, applied research and multidisciplinary collaboration, taking into account the business challenges of product innovation, and highlighting the intersection between symbolic knowledge (creativity), synthetic knowledge (technology and engineering) and marketplace.

In parallel, the co-working space will also foster an establishment of a resident community, maintaining the animation of space and the critical mass needed to respond to the challenges. More than a co-work space or a simple office, the intention is to build a space that enlarges the networks of contacts, enhances the productivity of any business and changes the attitudes, resulting in a greater personal and professional development.

Space of Performative Arts

The construction of a space for performative arts gains importance as a catalyst of knowledge in products, services and innovative processes. In this context, the challenge is to develop the conditions for artists, entrepreneurs and technologists to share the same ecosystem and language. For this, it is essential to have spaces that promote interaction and the creation of non-conventional solutions. It is an important space for promoting dialogue and accelerating the implementation of technology in artistic concepts, which can be explored in other industrial contexts. The role of creative industrialists in boosting the economies of cities is gaining more importance. There are several European examples of success related to creative processes between artists, entrepreneurs and technologists.

Experimental Space

Regarding the experimental spaces, the main idea behind their creation is to distil ideas/concepts of products that can be presented to potential end users. Its purpose is to create conditions for the development of scenarios to support the performative arts. Espinho's innovative ecosystem of experimentation includes equipment and tools and creative workshops. These spaces are intended to be inserted in an integrated way, into the dynamics of infrastructures and services in support of innovation, incubation and experimentation. This will allow to create a response capable of generating ideas and projects with the potential to attract new businesses, products and services to the local economic fabric and promote employability by preserving talent.

Critical Success Factors

The geographical position of the municipality, its integration in the Porto Metropolitan Area, boosted by the good accessibility by road and rail, gives the city of Espinho competitive advantage. These conditions, combined with the partnership and relations with the Universities of Porto and Aveiro, as well as the forthcoming establishment of a University in the city itself and connected to the area of Aeronautica (process in progress), would support the effective creation of the innovation ecosystem.

The relationship between the city and the sea is an integral part of the identity of Espinho, associated with its origins, which over time and in different ways has fuelled the development, identity and brand of the city. From a simple fishing place in the past, Espinho became an important place linked to the exploitation of fishery resources, due to the presence of the canning industry, Brandão Gomes, recognised in the national and European markets. Furthermore, the presence of the aerodrome associated to the possibility of the location of the University of Aeronautics, are two factors that also favour the innovative character of the proposed ecosystem.

The results of CASI at the service of co-working spaces

The project "Public Participation in the Development of a Common Framework for the Evaluation and Management of Sustainable Innovation" (CASI) emerges as a response to one of the Societal Challenges as pronounced in the Horizon 2020 Programme, namely 'Climate Action, Resource Efficiency, Raw Materials and Environment', and aims to build a common understanding on issues related to sustainable technological and social innovation. Furthermore, it explores the impact of innovative practices and aims to improve environmental sustainability, considering economic and social aspects, while actively promoting public involvement in the RTD&I system, ensuring a broad spectrum of stakeholders in the implementation of the project. The CASI project promotes the understanding of technological and social innovation as one of the main drivers of the progress of society and sustainability. For this reason, the expected results of the project related to capacity building and training in the area of innovation management processes, are close to the main idea of the co-working spaces.

Sustainable innovation further enhances this idea, introducing sustainability as a central nucleus of the innovation process. At the same time, this is not an attempt to introduce yet another distinct type of innovation but, specifically in the context of the CASI project, promote the debate on conceptual dimensions, policy boundaries and good practices, combining innovation-related objectives with sustainability objectives.

The main outcomes that emerged from the activities of the CASI project could be indispensable tools for users of co-working spaces, namely, business and research and education actors, and more indirectly, civil society and government actors.

These outcomes are:

• Shared cross-functional understanding of sustainable innovation;

• Common Framework for the Assessment and Management of Sustainable Innovation (CASI-F) – a 5-step methodological approach supported by several interconnected web-based solutions. The core tools supporting the assessment and management of sustainable innovation (SI) are CASIPEDIA (unique bank of sustainable innovation initiatives – their practices, outcomes and players), Ideas Bank (bank of critical issues affecting the success of SI – barriers, drivers, opportunities and threats) and Actions Bank (actions and more detailed roadmaps supporting the management of critical issues at different levels of management for the quadruple helix actors of SI) (Popper et al, 2017).

• Policy Watch with policy briefs (assessing national and European SI policies), annual policy reports (policy recommendations for steering research and innovation towards more sustainable futures) and blogs (a non-stop knowledge hub with opinions, statements and reflections about SI-related policies).

• Tutorial – a training package with 6 modules and 12 units including how-to-guide for the application of CASI-F, SI assessment and management concepts, lessons and recommendations from the CASI project, and more.

The business actors could use the mapping platform to identify opportunities and at the same time learn from competitors. The resulting analysis can support the (re)definition of SI strategies and reinforcement of SI management, while the advice would, on the one hand, facilitate the definition of actions and meta-actions and, on the other hand, support the development of more detailed actions roadmaps structured around the four main dimensions and 10 key SI management aspects.

The research and education actors may use the results of the mapping exercise as case studies, in lectures and in defining further research avenues. The results can inform management programmes, while the advice linked to generated actions can drive research careers through new research priorities.

CASI results can support civil society actors in discovering new products, services and social initiatives. The resulting analysis would allow civil society organisations (CSO) to recognise those SI management factors where public engagement is needed, thus increasing their participation in socially-oriented business activities. The advice generated from the analysis of innovations can increase CSOs' awareness of new research and innovation agendas and priorities.

Government actors, although not direct users of co-working spaces, will have very concrete results regarding the use of CASI project results. The resulting analysis can support the implementation of multiple policies addressing, for example, specific technological, economic, environmental, political, social, ethical or spatial issues.

Conclusion

The CASI project facilitated mobilisation and mutual learning of societal actors. CASI is a virtual co-working space available to a wide range of stakeholders. More specifically, the CASI framework (CASI-F) and supporting online tools can be considered as a living 'knowledge co-creation, co-assessment and co-management tool' (Popper *et al.*, 2017) aiming to explore the impact of sustainable innovation on the economic, social, environmental, governance and infrastructure systems transformation.

References

ENEI. (2014) Estratégia de Investigação e Inovação para uma Especialização Inteligente Ei&I

Arancegui, M. N. *et al.* (2011) Smart Specialisation Strategies: The Case of the Basque Country. *Orkestra Basque Institute of Competitiveness*, http://s3platform.jrc.ec.europa.eu/documents/20182/141136/Smart_Specialisation_Strategies_The_Case_Basque_Country.pdf

Dantas, E. and Bell, M. et al (2011) The co-evolution of firm-centered knowledge networks and capabilities in late industrializing countries: The case of Petrobras in the offshore oil innovation system in Brazil. *World Development* 39 (9): 1570-1591.

Freeman, C. (1987) *Technology Policy and Economic Performance: Lesson from Japan.* London, New York: Pinter Publisher.

Foray, D. and Van Ark, B. (2007) Smart specialisation in a truly integrated research area is the key to attracting more R&D to Europe,

McCann, P. and Ortega-Argiles, R. (2011) Smart specialisation, regional growth and applications to EU cohesion policy. *Regional Studies* 49 (8): 1291-1302.

Popper, R. and Velasco, G. (eds) (2017) *Sustainable Innovation Policy Advice*, CASI project report. Deliverable 7.2.

Popper, R., Velasco, G. and Popper, M. (2017) *CASI-F: Common Framework for the Assessment and Management of Sustainable Innovation*, CASI project report. Deliverable 6.2.

CHAPTER VII
Sustainable Innovation in education for Sustainable Development

Nedka Gateva, Technologica

Abstract

Education for Sustainable Development (ESD) represents a new vision of education, a vision that helps people of all ages better understand the world in which they live, emphasizing the need for stimulating a holistic, integrated and interdisciplinary approach to developing the knowledge and skills needed for a sustainable future as well as changes in values, behaviour, and lifestyles. This chapter presents sustainable innovation initiatives that were mapped and analysed in the CASI Project, and which share common features and approaches in addressing new learning experiences. This chapter also illustrates how the need for a new vision of education and learning environments is addressed in the research priorities explored and rated during the citizens-experts-citizens workshops carried out in 12 EU countries.

> **"Education is the most powerful weapon you can use to change the world."**
>
> **Nelson Mandela**

Introduction

"Education is an indispensable element for achieving sustainable development." (United Nations, 2004) People around the world recognise that the current economic development trends are not sustainable and that public awareness, education, and training are key to moving society towards sustainability. Education for sustainable development (ESD) refers to the use of education as a tool to achieve sustainability. In fact, it calls for giving people lifelong knowledge and skills to help them find new solutions to environmental, economic, and social issues.

From the time sustainable development was first endorsed at the **UN General Assembly in 1987**, the parallel concept of education to support sustainable development has also been explored. From 1987 to 1992, the concept of sustainable development matured as committees discussed, negotiated, and wrote the 40 chapters of **Agenda 21 from the Earth Summit (Rio de Janeiro, 1992)**. Initial thoughts concerning ESD were captured in **Chapter 36 of Agenda 21, "Promoting Education, Public Awareness, and Training."**

This chapter identified four major thrusts to begin the work of ESD, including:

(1)   improving access to quality basic education,

(2)   reorienting existing education to address sustainable development,

(3)   developing public understanding and awareness, and

(4)   providing training programmes for all sectors of private and civil society.

These four thrusts became major components of the United Nations Decade of Education for Sustainable Development (UNESCO, 2005).

ESD is about more than a knowledge base related to environment, economy, and society. It also addresses learning skills, perspectives, and values that guide and motivate people to seek sustainable livelihoods, participate in a democratic society, and live in a sustainable manner. ESD also involves studying local and, when appropriate, global issues.

While *Agenda 21* clearly identifies many of the critical issues that governments around the world agreed to address, additional issues that are important to enhancing the understanding of sustainability (e.g., globalisation) have continued to emerge since the Rio de Janeiro conference. These additional issues, not covered in *Agenda 21*, are part of international discussions of sustainability and include, but are not

limited to, topics such as war and militarism, governance, discrimination and nationalism, renewable energy sources, multinational corporations, refugees, nuclear disarmament, human rights, and media influencing rapid change of worldviews. These issues are pertinent to reorienting education to address sustainability and should be included when relevant. Including local issues will foster innovative solutions and develop the political will to resolve them.

To be successful, ESD must go beyond teaching about these global issues. ESD must give people practical skills that will enable them to continue learning after they leave school, to have a sustainable livelihood, and to live sustainable lives.

Values are also an integral part of ESD. In some cultures, values are taught explicitly in the schools. In other cultures, however, even if values are not taught explicitly, they are modelled, explained, analysed, or discussed. In both situations, understanding values is an essential part of understanding your own worldview and other people's viewpoints. Understanding your own values, the values of the society you live in, and the values of others around the world should be a central part of education for a sustainable future.

Regarding the values, it is worth mentioning the **Earth Charter** Initiative. The Earth Charter was created by the independent Earth Charter Commission, which was convened as a follow-up to the 1992 Earth Summit in order to produce a global consensus statement of values and principles for a sustainable future. The document was developed over nearly a decade through an extensive process of international consultations, to which over five thousand people contributed. The Charter has been formally endorsed by thousands of organisations, including UNESCO and the IUCN (World Conservation Union). (Ref. www. EarthCharter.org.)

The Earth Charter is a synthesis of values, principles, and aspirations that are shared by a growing number of people and organisations around the world. Drafting the Earth Charter was part of the unfinished business of the Earth Summit. Currently, the Earth Charter is being disseminated to individuals and organisations in all sectors of society throughout the world. It says:

"We urgently need a shared vision of basic values to provide an ethical foundation for the emerging world community. Therefore, together in hope we affirm the following interdependent principles for a sustainable way of life as a common standard by which the conduct of all individuals, organisations, businesses, governments, and transnational institutions is to be guided and assessed:

1.   Respect and care for the community of life

2.   Ecological Integrity

3.   Social and Economic Justice

4.   Democracy, Nonviolence, and Peace"

This concept is very much at the heart of ***Pope Francis's message in the Encyclical Letter (Laudato Si')*** (Pope Francis, 2015) which concludes well with this part: "The analysis showed the need for a change of course ... we must escape the spiral of self-destruction in which we are sinking" (n.163). It is not a reform, but, citing the Earth Charter, to seek "a new beginning" (n.207). The interdependence of all with all leads us to believe "in one world with a common project" (n.164).

Pope Francis refers to education in the sense of creating "ecological citizenship" (n.211) and a new lifestyle, based on caring, compassion, shared sobriety, the alliance between humanity and the environment, since both are umbilically linked, and the co-responsibility for everything that exists and lives and our common destiny (nn.203-208).

To some extent CASI contributes to the appeal of the Pope: "The urgent challenge to protect our common home includes a concern to bring the whole human family together to seek a sustainable and integral development, for we know that things can change." (n.13).

From sustainable innovation cases

Learning for sustainable development can be described as a joint search of individuals and organisations for knowledge and competences that enable them to deal with dilemmas in complex societal settings. That type of learning asks for authentic and open learning environments in which encounters with a diversity of disciplinary and stakeholder perspectives can take place. Most learning environments in traditional formal education do not optimally support that type of learning. Learning for sustainable development therefore constitutes a trigger for innovations in education.

In CASI we mapped and piloted five sustainable innovation (SI) cases which share common missions, and activities designed to bring new learning environments and content in education of children and young people.

• **3D Ecobus – Mobile Education Centre**, a unique on a worldwide scale innovative mobile information and education centre that visits schools in Bulgaria to inform children on waste recycling, and above all, enlists them as ambassadors of the green idea and separate waste collection.

The 3D Ecobus is often referred to as 'The Flying Classroom' and that is exactly what it is – a classroom on wheels, but one that seems to have arrived from the future – with 42" 3D mobile displays, Dolby Digital Surround Sound and Audience Response System (ARS), which turn the 40-minute learning session into an unforgettable experience and the children – into devoted ambassadors of the green idea and separate waste collection. More than 100,000 children from 500 schools and kindergartens in 80 municipalities have joined the battle for keeping precious natural resources from piling up at the landfills. More than 5,000 employees of big companies as well as municipal servants have also gone through the recycling and sustainable development training programme.

Ecobus has been developed in 2011 by a Bulgarian company DeConi as a campaign to inform people about the benefits and necessity of separate collection of packaging waste. The success of the project (it has a number of awards, including international) motivated DeConi to apply the model in other areas. Ecobus is now part of a much larger project called 3D ME (3D Mobile Education). The next stages of the 3D ME project are built upon the gathered experience and incorporate the philosophy of 3D Ecobus. Permalink of this case: http://www.casi2020.eu/casipedia/cases/1163

• **Climate Doctor** is a blog initiative in Finland that discusses climate related issues with the aim of promoting sustainable lifestyles by educating people about the climate implications of their actions.

Climate Doctor is a blog (in Finnish) that discusses climate related issues with the aim of promoting sustainable lifestyles by educating people on the climate implications of their actions. The initiative gives advice to people on how to start a climate diet. The specialists of the Finnish Environment Institute evaluate for example the climate impact of inappropriate use of grocery shopping bags. Permalink of this case: http://www.casi2020.eu/casipedia/cases/1116

• **Fifty/fifty** is an initiative involving over 3,500 schools in Germany. The participating schools receive funds equal to 50% of the energy costs saved through conscious usage. Climate and energy are also in the focus of lessons, project days, study groups and excursions.

Fifty/fifty is an initiative with participation of over 3,500 schools (10% of general education schools) in Germany. The basis of the Fifty/fifty concept is that 50% of the total energy (and money) savings achieved from the energy efficiency measures implemented by the students and school staff are retained by the school. Schools can use this funds at their discretion. The other 50% remain with the school district. This incentive contributes to environmental and climate protection as well as cost reductions. Schools get additional financial resources, students learn about energy efficiency; managers of school buildings have less energy costs, and energy efficient schools contribute to local energy and climate change targets.

The school children learn how to save energy and spread the information into their families. As a consequence, the project can be seen as a grass roots approach to educate the members of society at a very early stage and in the long run raise awareness about the topic in the whole society. Permalink of this case: http://www.casi2020.eu/casipedia/cases/1057

- **Dinosaur's Park** – Delta Association was created to organise river trips for tourists in municipality of Bałtów (Poland) and later it developed new types of attractions with focus on children and families creating what they call "Children Touristic".

Delta Association was established to fight the rising unemployment in municipality of Bałtów. Delta started to organise river trips for tourists, attracted to the area by the recent discovery of dinosaurs' bones. Currently Delta Association employs hundreds of people in Bałtów in their theme park. Delta created several parks in Poland and developed new types of attractions. Their focus on children and families created what they call "Children Touristic" and their activities created new businesses type in regional economy, transforming it into service based economy. Permalink of this case: http://www.casi2020.eu/casipedia/cases/1335

- **Eco-Schools** in Slovenia is an internationally awarded programme that guides schools on their sustainable journey, providing a simple framework to help make sustainability an integral part of school life. Their mission is to help make every school in the country sustainable and to bring about behavioural change among young people and those connected to them so that good habits learned in schools are followed through into homes and communities.

The Eco-Schools programme can help enhance the curriculum and get the whole school united behind something important. Once registered, schools follow a simple seven-step process which helps them address a variety of environmental themes, ranging from litter and waste to healthy living and biodiversity.

More than 132,000 children, pupils, secondary and post-secondary school students, and 8,600 educators, teachers and professors (eco-coordinators), mentors and project leaders participate in the Eco-School programme. The number of institutions taking part is growing larger every year, ensuring the permanent support for activities according to the 7 steps methodology. Permalink of this case: http://www.casi2020.eu/casipedia/cases/1370

All the above cases are related to the education of young people in schools or through extra-curricular activities aimed at increasing knowledge sharing with regards to sustainable living, technologies, etc.; facilitation of discussions about sustainability and sustainable consumption; and more generally to increase awareness on sustainable lifestyles.

Relevant key SI priorities from the analysis of Sustainable Innovations

In CASI we have involved stakeholders in discussions about sustainable innovations and Societal Challenge 5. Citizens who participated in CASI citizen panels have, for example, developed visions on education for sustainable future which were later translated by experts into concrete research priorities. Public engagement in research, education and decisions is of paramount importance to our joined efforts, aimed at tackling the root causes and do more to integrate the economic, social and environmental dimensions of sustainable development.

The CASI Project has provided new and original contributions to sustainability research and innovations agendas, as well as citizens' priorities for research. Based on the analysis of sustainable innovation priorities, education for sustainable development has emerged among the top-level Key SI Priorities (Popper *et al.*, 2017).

From the analysis of Sustainable Social Innovations: SI Priority 2 on promoting sustainable lifestyles and consumption patterns through knowledge sharing.

SI priority 2 is one of the key 11 priorities that emerged from the analysis of sustainable social innovation initiatives. Objectives clustered under this SI priority include: (1) educating the young people in schools or through extra-curricular activities, such as those offered by the 3D Ecobus that visits schools in Bulgaria; (2) increasing knowledge sharing with regards to sustainable living, technologies, etc.; (3) facilitating discussions about sustainability and sustainable consumption; and more generally (4) increasing awareness on sustainable lifestyles.

From the analysis of Sustainable Organisational Innovations: SI Priority 1 on implementing energy and water saving practices in schools and working environments.

The top 1 priority is reflected in a number of organisational innovations' objectives. The priority entails, in particular, promoting and realising energy and water savings at schools. Other examples include education about saving energy with the objective of more efficient energy use in the children's homes. A concrete example is the 'Fifty/Fifty School Programme' presented above.

The transition to a sustainable, innovation-oriented society is required to successfully approach societal challenges, including those of Societal Challenge 5 that focuses on 'Climate action, environment, resource efficiency and raw materials'. The transition, however, is a major challenge for policymakers, research and development (R&D) actors, investors, businesses and individuals, and calls for comprehensive policies at all levels i.e. local, regional, national and global. The successful transition deployment entails understanding the behaviour that leads to public acceptance of technologies, while socio-economic research must translate behavioural theory into practicable recommendations. Governments have to provide effective legal and regulatory frameworks, ensure public policy coherence across its mandates, and build and maintain public acceptance to support the uptake of different types of sustainable innovations, including products, services, social system, governance, and organisational and marketing innovations.

Multi-stakeholder engagement, as promoted within the CASI project, is crucial to assure implementation of solutions in a sustainable manner, and the existing successful models highlighted in some of the above noted examples of sustainable innovations, shall be used as case studies for promoting such an approach at the European level and moreover, as an input for creating future European policies.

Relevant European research priorities as voted by citizens in 12 countries

The core of the CASI project has been the facilitation of public participation through various activities. Citizens have been directly involved to contribute with their visions about the sustainable future. The applied multi-stage *'citizens-experts-citizens' process* within CASI proved successful in fulfilling its overall objective, namely generating a number of citizen-informed visions, translating them into interim expert-elaborated research priorities, before putting them to wider verification by citizens once more, for the purpose of ensuring a uniform process in all countries, and allowing eventually for a strategic comparison of the results.

Citizens Priority 2: Holistic Education for a Sustainable Future

This research priority focuses on how to identify and elaborate the skill-set that is needed for 'eco-citizenship'. Further research should be directed at exploring the differences between types of educational systems to establish whether, and how, they promote eco-citizenship. Also, research should explore which characteristics of educational systems are relevant in this regard, and how the educational systems can adapt to a more holistic mind-set and, finally, how educational systems are perceived and valued in different countries.

Table 5: Expert-elaborated priorities derived from the citizens' visions, according to overall rank

Expert Rank & Expert Elaborated Research Priority	Originating Citizens' Visions (by Country Panels)
=4 Holistic education for a sustainable future	Education - a path to spiritual and sustainable future' (Bulgaria) & 'Education=aware citizen=aware society=sustainability' (Poland)

Policy recommendation: The EU should promote eco-citizenship as part of the curriculum in schools and as a part of adult education. Eco-citizenship should be promoted as part of education on European Level.

Research priority and policy recommendation stemmed from the visions: 'Education - a path to spiritual and sustainable future' and 'Education=aware citizen=aware society=sustainability'.

(All 27 research priorities and the visions from which they stem are presented in Popper *et al.*, 2017. For some of the research priorities the experts also suggested policy recommendations).

Clearly a sustainable future is in the hands of the young and the education system, but it is also in the hands of citizens and workers and policy-makers at all levels, whose skill-base and knowledge-base can shape the world as it is. In this light, the CASI evidence-base that emerged from the Citizen' Panels is particularly relevant and demonstrates that underlying the conventional trappings of a modern consumerist, high mobility and high impact society seem to be the foundations of an alternative and more sustainable model. This plays out in the SI cases, where not only school curriculum design but alternative notion of 'what is a school' are explored.

The CASI cases demonstrate some ways into this, but the next R&I programmes should explore systematically the potentials and also the barriers to education for sustainability.

Conclusion

This chapter has presented in brief the CASI experience related to education for sustainable development. The various multi-perspective approaches that have been combined, namely the evidence-based analysis of SI initiatives, SI policies, and SI aspirations, reveal the extent to which CASI Project has accomplished its stakeholder mobilisation and mutual learning principles. The generation of knowledge base and its effective circulation and transfer between the SI actors proved to be a powerful tool in supporting the development of forthcoming SI policies and programmes at EU level, and in envisioning the direction the efforts and programmes promoting education for sustainable development could take or should take, both at national, and EU level.

"For we know that things can change."
Pope Francis

References

CASIPEDIA (2017) *State-of-the-art of Sustainable Innovation Database*. [Online]. CASI Work Package 2 led by the University of Manchester, CASI project. http://www.casi2020.eu/casipedia/.

Earth Charter Commission (2000) The Earth Charter, http://earthcharter.org/invent/images/uploads/echarter_english.pdf

Pope Francis (2015) *Encyclical Letter (Laudato Si') of the Holy Father Francis, on care for our common home*, http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html

Popper, R., Velasco, G., Bleda, M., Amanatidou, E., Ravetz, J., Damianova, Z., Kozarev, V., Chonkova B., Tsin, S., Avarello, A., Martin, L. and Morris, D. (2016) *Sustainable Innovation Conceptual Framework*. CASI project report. Deliverable 2.2.

Popper, R., Velasco, G. and Popper, M. (2017) CASI-F: *Common Framework for the Assessment and Management of Sustainable Innovation*, CASI Project Report. Deliverable 6.2.

Popper, R., Velasco, G., (eds) (2017) *Sustainable Innovation Policy Advice*, CASI Project Report. Deliverable 7.2.

UNESCO (2005) *Education for Sustainable Development*. ESD Information Briefs.

United Nations Sustainable Development (1992) *Agenda 21* (United Nations Conference on Environment & Development, Rio de Janerio), https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf

United Nations (2004) *General Assembly Resolution 58/219*. New York: United Nations.

CHAPTER VIII
Sustainable innovation policy, focus on issues alongside challenges

Kaisa Matschoss, University of Helsinki
Petteri Repo, University of Helsinki

Abstract

The European Union has identified a key societal challenge that is defined in terms of climate action, environment, resource efficiency and raw materials (SC5). This chapter reviews if policies for sustainable innovation should be developed according to these four definitions. To this aim, it carries out topic modelling of recommendations evident in CASI policy briefs, which have been published in 28 European countries. The chapter argues that it would be worthwhile to consider a diversity of issues alongside pre-defined challenges when developing policies for sustainable innovation.

Introduction

Societal challenge 5 (SC5) of the European Union's research and innovation programme Horizon 2020 focuses on climate action, environment, resource efficiency and raw materials (EC, 2017). These four sustainability sub-challenges both define SC5 and reflect how they are to be addressed in the growth strategy of the EC, Europe 2020. Yet, this definition is incomplete in the sense that the differences and overlaps between these four sub-challenges are not defined very clearly.

The description of the SC5 does not make it clear whether the sub-challenges should be seen as independent domains (i.e. issues) or if focus should be in cross-linkages, which should be accounted for. Additionally, the societal challenges may further be broken down to lines of activities (EC, 2017) or a great number of priorities (see Popper, Velasco & Ravetz, 2016). As the sub-challenges are used to coordinate and allocate European funding, this question is accordingly of key importance for future research and innovation policy. Policies can be of general scope or specific and targeted. This chapter also reviews the scope (general/specific) of policies relating to sustainable innovation and SC5.

Policy watch activities in the CASI project allow tackling the question of independence and cross-linkages of the sub-challenges. When monitoring debates in policies relating to SC5 and sustainable innovation in 12 project partner and 16 correspondent countries, the project provides a unique opportunity to review this question from a policy perspective.

A key contribution of the policy watch has been to produce and disseminate 103 national level policy briefs on selected topics during the first three years of the project. The briefs all address SC5 from the point of view of innovation that is sustainable, and are cross-cutting in the sense that each of them relates to three or four of its sub-challenges. Each policy brief contains either a takeaway or dedicated section for recommendations for policymakers, which serves as the analysed data in this chapter. These recommendations are the results of policy analysis and provide policymakers with practically oriented and nationally contextual forward-looking policy options (see Bromell, 2017; Weimer & Vining, 2016).

This chapter reviews the question of interdependence and cross-linkages by examining topics in the policy recommendations of the policy briefs. In practice, the distribution of topics across recommendations and the issues they relate to is reviewed through the method of topic modelling. In the upcoming section, we introduce the analysed policy data and the applied method of topic modelling. Then we present the findings of the modelling analysis, which indicate that the sub-challenges of SC5 should rather be considered independently of each other than to be seen cross-linked. In the concluding section of this chapter, we discuss the impacts of the findings for the future of research and innovation funding, arguing for large variety instead of integrative approaches in funding.

From recommendations to topics

This section presents the policy issues related to sustainable innovation considered in the CASI policy briefs, and their linkages to the SC5 as well as the research method. Altogether, six issues of policy briefs are included in this analysis: smart cities, eco-innovation action plan, Europe 2020 strategy, crowdfunding, research priorities for sustainable innovation, and sectoral consideration of sustainable innovation policies related to SC5. Table 7 summarises the national level policy brief issues and how they relate to the sub-challenges of SC5 and sustainable innovation.

Table 6: Issues of the policy briefs related to SC5

Policy Brief Issue title	Societal challenge 5, focus	Number of countries	Publication date
Smart Cities as Sustainable Innovation Actors	Climate action, resource efficiency, raw materials	12	June 2014
The Eco-Innovation Action Plan in an Environmental Policy Context	Climate action, environment, resource efficiency, raw materials	20	December 2014
Europe 2020: Towards Growth and Resource Efficiency	Resource efficiency, climate action	23	June 2015
Crowdfunding in Sustainable Innovation	Climate action, environment, resource efficiency, raw materials	24	December 2015
Top-10 Research Priorities for Sustainable Futures	Resource efficiency, climate action, environment, raw materials	12	June 2016
Sustainable Innovation across Key Sectors and Societal Challenge 5	Resource efficiency, climate action, environment, raw materials	12	December 2016

The Table 7 shows that the issues discussed in the policy briefs are cross-cutting in the sense that they all address several sub-challenges of the SC5. This suggests that the recommendations of the different issues of the policy briefs could also include cross-cutting topics that relate to climate action, resource efficiency, raw materials or the environment.
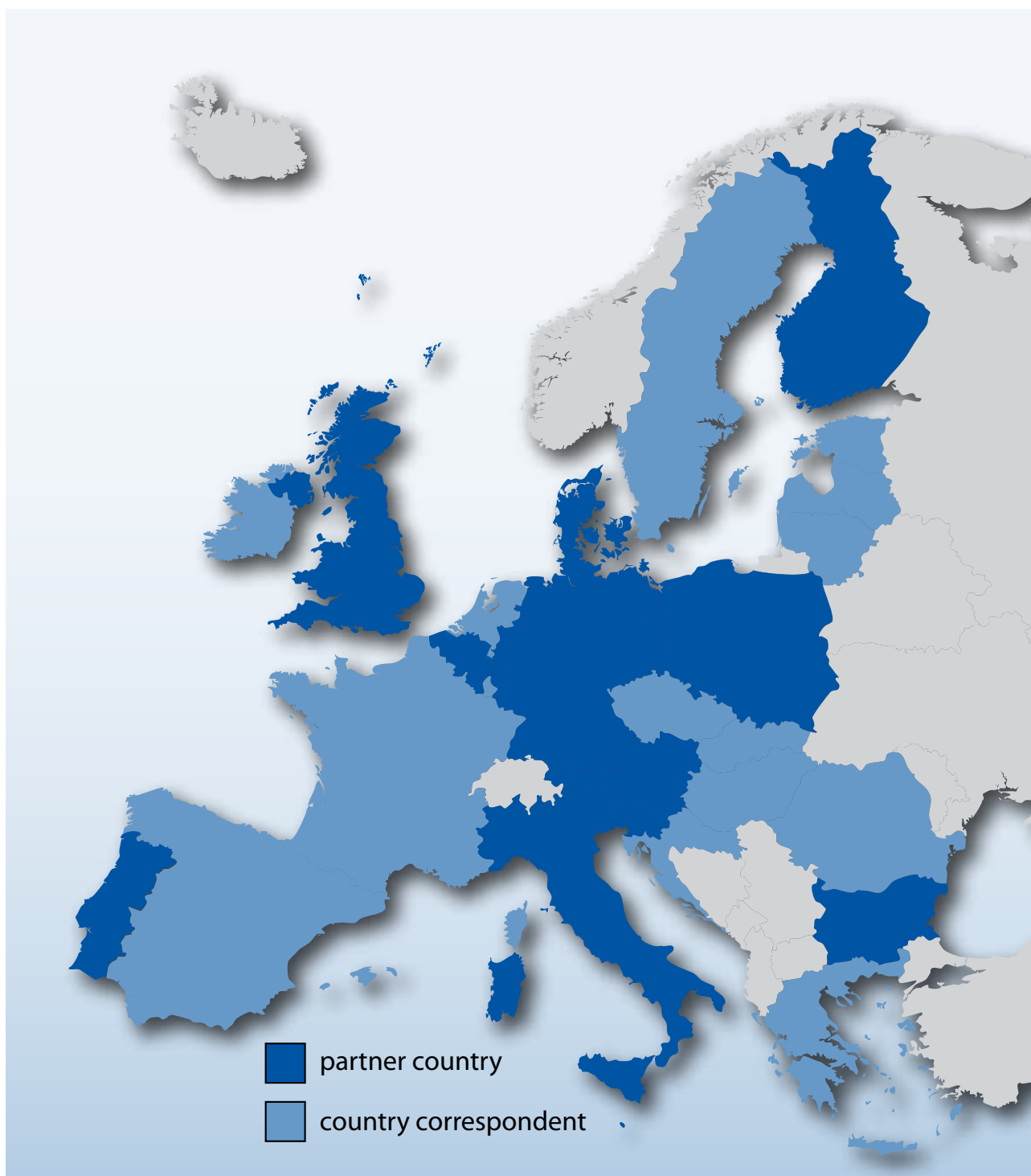
Figure 11: Origins of the policy briefs

Project partners from Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, Germany, Italy, Poland, Portugal, Slovenia and United Kingdom have generated a brief to each issue and the 16 country correspondents from the other EU-28 countries have each provided 2 briefs (1 correspondent provided 1). Figure 11 presents the CASI partner countries and the corresponding countries.

The studied data ranges from June 2014 to December 2016. While policy debates evolve over time, these debates nevertheless relate to the same societal challenge, and the recommendations approach them in a forward-looking manner. Therefore, it can well be argued that the outcomes of these policy briefs are comparable. Comparing policy recommendations related to sustainable innovation in these European countries provides insights how the European Union is addressing Societal Challenge 5 on climate action, environment, raw materials and resource efficiency. We follow the guidelines of comparative politics

(see Lijphart, 1971; Wiarda, 2006) when determining the issue to be compared – in our case: the policy recommendations in sustainable innovation relating to SC5. The policy recommendations represent the assessments of the project partners on how to foster, improve or challenge existing policies and, thus, represent responses to key observations related to European developments in the policy fields examined in the issues of the CASI policy briefs.

The data is comprised of policy recommendations that were derived from 103 national level policy briefs. The sustainability policy issues addressed in these documents have been identified through preceding European level considerations. The policy briefs have focused on the national reflections of the policy, providing a comparison to overall European developments by project partners and country correspondents. The policy briefs follow a similar structure in each topic and for each country presenting their representative and relevant policy developments related to each issue at hand. They all provide recommendations for policymakers or a take away for them.

The recommendations address different actors in different phases of the policy cycle. They also focus on citizen involvement or public participation in various ways. We present here some examples of policy recommendations in the published CASI policy briefs:

- Encourage citizens' involvement for successful deployment of smart cities solutions. (Issue: Smart Cities as Sustainable Innovation Actors, Portugal)

- More focus on, and funding of, adoption and diffusion of eco-innovations. (Issue: The Eco-Innovation Action Plan in an Environmental Policy Context, Czech Republic)

- Develop a sustainable energy policy with a long-term vision to ensure sufficient electricity generation capacity. (Issue: Europe 2020: Towards Growth and Resource Efficiency, Belgium)

- Support the development of instruments for alternative financing to provide opportunities for small businesses and social entrepreneurs to finance their innovative initiatives and products. Appropriate regulatory framework, which guarantees the rights of crowdfunding platforms' users, focusing on the operational and financial transparency practice, financial control, security of information and payments, will need to be developed as the popularity of crowdfunding platforms and other forms of alternative financing increases. The regulatory framework needs to be developed in a wide consultation with organisations active in supporting businesses and social enterprises, as well as other relevant stakeholders. (Issue: Crowdfunding in Sustainable Innovation, Bulgaria)

- Sustainability as a concept should be integrated into the efforts to foster the establishment of new businesses. So far only separated approaches exist like those outlined in the government programme for 2013-2018. (Issue: Top-10 Research Priorities for Sustainable Futures, Austria)

- Integrate circular economy as part of the conditions for polices and initiatives supporting sustainable innovation in manufacturing and retail. (Issue: Sustainable Innovation across Key Sectors and Societal Challenge 5, Denmark)

The recommendations in the policy briefs provide a rich and varied data set that can be used for finding patterns across topics and structures. For instance, policy recommendations on growth and resource efficiency have been used to pilot the CASI-F common framework for the assessment and management of sustainable innovation (Repo et al, 2016). When using such recommendation data, it should be kept in mind that the data represents assessments on how to improve or challenge current policies rather than simply describing policy debates.

The policy recommendations are analysed through topic modelling. Topic modelling is based on the idea that texts can be understood through their underlying concepts, i.e. topics (Rehurek and Sojka, 2010). It is thus a suitable tool for analysing unstructured textual data such as the policy recommendations, which relate to numerous policy details and national contexts. Through topic modelling we can cluster similarities across the corpus of policy recommendations.

The technique used in the topic modelling is latent Dirichlet allocation, which is a generative probabilistic model (Blei et al, 2003). The clustering procedure looks for patterns of words and thereby extracts topics from texts. A topic is in this sense a probability distribution of words that frequently appear together –

i.e. clusters of words (see Steyvers & Griffiths, 2007). In our analysis, all policy recommendations (i.e. corpus) define the topics, and each policy brief issue contains a mixture of topics.

As a tool, we use MALLET which is popular in statistical natural language processing and analysis. In the preparation stages of the modelling, we identified that seven topics worked well for the corpus (see Graham et al, 2012). Common stopwords such as 'a' and 'at' were filtered out before analysis, and the analysis was carried out with 40 sampling iterations thus ensuring that topics were identified well (Wallach et al, 2009). The next section will present the results of the topic modelling using the policy recommendations.

Topics and issues

This section presents the topics emerging from the topic modelling analysis described in the previous section: Public sustainable innovation (SI) policy, smart cities, eco-innovation, citizens and research priorities, industry, renewable energy and resource efficiency, and crowdfunding (Table 8). The topics were named on the basis of respective word clusters (7 most probable words presented in the table), and are remarkably similar to the policy brief issues. The weights of the topics are presented in the last row of the table, showing relative prevalence in the recommendation corpus.

Table 7: Identified topics and their relative weights

Public SI policy	Smart cities	Eco-innovation	Citizens & research priorities	Industry	Renewable energy & resource efficiency	Crowd-funding
Public	cities	eco-innovation	Citizens	manufacturing	energy	crowd-funding
sustainable	smart	funding	Research	raw	efficiency	projects
Policy	citizens	priorities	Priorities	growth	resource	platforms
innovation	concept	technology	sustainability	product	renewable	financing
Energy	making	order	Society	total	policy	alternative
development	ecological	designing	Food	design	transport	money
Support	active	eco-innovations	agriculture	resource	targets	potential
1,834	**0,320**	**0,268**	**0,185**	**0,125**	**0,112**	**0,09**

The first topic in the table is about public policy relating to innovations promoting sustainability. It is a topic that clearly emerges from the policy recommendations and has great weight. The second topic deals with cities, smartness and active citizens, and the third with eco-innovations. The fourth topic that emerges from the policy recommendations relates to citizens and research in sustainability and society. The fifth topic is focused on manufacturing, growth, products and resources, so it was named "industry". The sixth topic deals with energy, efficiency, resources and renewables. In fact, it is a topic most closely related to the societal challenge 5. The seventh topic includes terms such as crowdfunding, financing, platforms and money, and it was named accordingly "crowdfunding".

Next we look at how the topics are distributed across policy issues. Table 9 presents the distribution of topics identified in the data in relation to the issue of the policy briefs. It shows that each policy brief issue is related to the general topic of public SI policy, but otherwise contributes mainly to one additional specific topic. For instance, the issue of smart cities is topically prevalent (0,544) in "public SI policy" and in "smart cities" (0,453). It has hardly any weight in the other topics. A similar topical distribution

between public SI policy and another main topic applies for the policy brief issue of eco-innovation ("eco-innovation") and the policy brief issue on key sectors ("industry").

Table 8: Distribution of topics across issues

Topic Name of issue	Public SI policy	Smart cities	Eco-innovation	Citizens & research priorities	Industry	Renewable energy & resource efficiency	Crowd-funding
Smart cities	0,544	0,453	0,001	0,001	0,001	0,000	0,000
Eco-innovation Action Plan	0,578	0,002	0,414	0,001	0,000	0,000	0,004
Europe 2020	0,456	0,013	0,032	0,024	0,014	0,461	0,000
Crowd-funding	0,279	0,061	0,032	0,003	0,000	0,000	0,626
Top-10 research priorities	0,420	0,005	0,008	0,566	0,000	0,000	0,000
Key sectors	0,585	0,000	0,040	0,000	0,287	0,086	0,000

As for the other issues, the specific topic is more prominent than the general topic. This is the case for policy brief issue Europe 2020 and the topic "renewable energy and resource efficiency", issue of Top-10 research priorities and the topic "citizens and research priorities" and especially for issue of crowdfunding and the topic of "crowdfunding".

In conclusion, the analysis shows that the policy recommendations evident in the six studied policy brief issues all relate to the topic of public sustainable innovation policy and another specific topic, but that there is no significant distribution of topics across issues. This indicates that no cross-cutting topics emerge in policy recommendations, suggesting that a large number of issues should be covered in policy analysis in societal challenge 5 on climate action, environment, raw materials and resource efficiency.

Discussion and concluding remarks

This chapter has reviewed if policies for Societal Challenge 5 on climate action, environment, raw materials and resource efficiency should be developed according to these four definitions.

The rich and varied data developed in the CASI policy watch gave a good opportunity to examine such a policy concern. An analysis of recommendations from 103 policy briefs showed that while the addressed policy brief issues are cross-cutting in terms of societal challenge 5 (see Table 7), the distribution of topics in the recommendations is not. This implies that policy recommendations and the SC5-policies they target do not emerge as general by-products of SI policy activities but need to be specifically targeted. The results of the analysis enforced by this finding point to the conclusion that each area of SI policy should be approached as a separate issue that requires specific policy attention and not as an area where a general policy setting would bring the best results. Of course, specific policies also connect to a general public policy, as the analysis confirmed.

For the research and innovation funding, this would mean the application of rather a large variety of approaches instead of integrative approaches in funding. In addition, while developing policies for sustainable innovation, it would be worthwhile to consider a diversity of issues alongside pre-defined challenges.

References

Blei, D. M., Ng, A. Y. and Jordan, M. I. (2003) Latent Dirichlet Allocation. *Journal of Machine Learning Research* 3 (Jan): 993-1022.

Bromell, D. (2017) *The Art and Craft of Policy Advising. A Practical Guide.* Cham: Springer.

EC (2017) *Societal Challenges.* https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges (accessed on February 1, 2017).

Graham, S., Weingart, S. and Milligan, I. (2012) Getting Started with Topic Modelling and MALLET. http://programminghistorian.org/lessons/topic-modeling-and-mallet (accessed on February 1, 2017).

Lijphart, A. (1971) Comparative politics and the comparative method. *American Political Science Review* 65 (03): 682-693.

McCallum, A. K. (2002) MALLET: A Machine Learning for Language Toolkit. http://mallet.cs.umass.edu (accessed on February 1, 2017).

Popper, R., Velasco, G. and Ravetz, J. (2016) *State of the art of Sustainable Innovation: Climate Action, Environment, Resource Efficiency and Raw Materials.* With contributions from Popper, M., Linford, S., Avarello, A., Martin, L. and Morris, D. Deliverable 2.1 of the CASI project.

Rehurek, R. and Sojka, P. (2010) Software Framework for Topic Modelling with Large Corpora, in *Proceedings of the LREC 2010 Workshop on New Challenges for NLP Frameworks*.

Repo, P., Matschoss, K., Tregner-Mlinaric, A., Van Eynde, S., Ramioul, M., Damianova, Z. and Kozarev, V. (2016) 'Assessing Sustainable Innovation Policies with the CASI Framework,' in Popper, R. and Velasco, G. (eds) *Sustainable Innovation Policy Advice*. Second CASI annual report on policy developments and initiatives.

Steyvers, M. and Griffiths, T. (2007) Probabilistic topic models. *Handbook of Latent Semantic Analysis* 427 (7): 424-440.

Wallach, H. M., Murray, I., Salakhutdinov, R. and Mimno, D. (2009) Evaluation Methods for Topic Models, in *Proceedings of the 26th Annual International Conference on Machine Learning:* 1105-1112. ACM.

Weimer, D. L. and Vining, A. R. (2016) *Policy Analysis: Concepts and Practice.* London: Routledge.

Wiarda, H. J. (2006) *Comparative Politics: Approaches and Issues.* Rowman & Littlefield Publishers.

All examined policy briefs can be found at www.CASI2020.eu.

List of CASI partners

PP1/ARC Fund

Applied Research and Communications Fund
5 Alexander Zhendov St
Sofia 1113
Bulgaria
T +359 2 973 3000
WWW.ARCFUND.NET

PP2/CUE

Coventry University Enterprises Limited
Priory Street
Coventry, United Kingdom
CV1 5FB
T +44 (0) 24 7688 7688
WWW.COVENTRY.AC.UK

PP3/DBT

Danish Board of Technology Foundation
Arnold Nielsens Boulevard 68E
2650 Hvidovre
Denmark
T +45 33 32 05 03
WWW.TEKNO.DK

PP4/CSRC

**Consumer Society Research Centre,
University of Helsinki**
P.O. Box 3 (Fabianinkatu 33)
FI-00014 Helsingin yliopisto
T +358 294 1911
https://www.helsinki.fi/en/researchgroups/
consumer-society-research-centre

PP5/TUDo

Sozialforschungsstelle Dortmund
EvingerPlatz 17
44339 Dortmund
Germany
T +49 231 8596-0
WWW.SFS-DORTMUND.DE

PP6/UP

University of Primorska
Titovtrg 4
6000 Koper / Capodistria
Slovenia
T +386 56 117523
WWW.UPR.SI

PP7/PSTP

Poznan Science and Technology Park
ul. Rubież 46
61-612 Poznań
Wielkopolska
Poland
T +48 61 827 97 00
WWW.FUNDACJA.PPNT.POZNAN.PL

PP8/INOVA+

Inova+
Centro de Inovação de Matosinhos
Rua Dr. Afonso Cordeiro, 567
4450-007 Matosinhos
Portugal
T +351 229 397 130
WWW.INOVAMAIS.EU

PP9/META

META Group S.r.l.
Viale Umberto Tupini 116,
00144 Roma (RM)
Italy
T +39 07 44 24 82 20
WWW.META-GROUP.COM

PP10/INCREASE TIME SA

Increase Time SA
Rua Dr. Afonso Cordeiro, 877
Sala 201
4450-007 Matosinhos
Portugal
T +351 229 396 355
WWW.INCREASETIME.PT/

PP11/COMUNE DI MONZA

Municipality of Monza
Piazza Trento e Trieste
20900 Monza
Italy
T +39 39 23721
WWW.COMUNE.MONZA.IT

PP12/MUNICIPIO DE ESPINHO

Câmara Municipal de Espinho
Praça Dr. José Oliveira Salvador
Apartado 700
4501-901 Espinho
Portugal
T +351 227 335 800
WWW.PORTAL.CM-ESPINHO.PT

PP13/ZSI

Centre For Social Innovation Ltd
Linke Wienzeile 246
A-1150 Wien
Austria
T +43 1 495 0442
WWW.ZSI.AT

PP14/UNIMB

Università degli Studi di Milano-Bicocca
Piazza dell'Ateneo Nuovo, 1
20126 Milano
Italy
T +39 2 6448 1

PP15/Cleantech Bulgaria

Cleantech Bulgaria
111 B Tsarigradsko Shose Blvd
Sofia Tech Park
1784 Sofia
Bulgaria
T +359 888 256123
WWW.CLEANTECH.BG

PP16/UNIMAN

The University of Manchester
Oxford Road
Manchester M13 9PL
United Kingdom
T +44 161 306 6000
WWW.MANCHESTER.AC.UK

PP17/KU Leuven

KU Leuven
Oude Markt 13
Bus 5005 3000 Leuven
Belgium
T +32 16 32 40 10
WWW.KULEUVEN.BE

PP18/TL

TechnoLogica
46 Chervenastena St
1421 Sofia
Bulgaria
T +359 2 91912
WWW.TECHNOLOGICA.COM

PP19/FD

Futures Diamond, s. r. o.
Plzeňská 98
150 00 Prague 5
Czech Republic
T +44 75 211 38154
WWW.FUTURESDIAMOND.COM