

# The translation of transformative policy ambitions in funding research for climate change

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This paper addresses how research and innovation (R&I) policy responds to global challenges, which demand fundamental transformations of societies and economies. The paper presents the case of a transnational, European funding call (SOLSTICE) for climate change research led by social sciences and humanities. Both the development of SOLSTICE and the research community's responses are analysed in relation to the transformative R&I policy literature, identifying potential future avenues for improving the transformative outcomes of this type of funding. The study concludes that unlocking the value of transformative R&I policy concepts and approaches depends on wide stakeholder engagement in the funding instrument design phase and an active and sustained focus on achieving societal outcomes during project implementation. In addition, barriers to the effectiveness of (European) transnational funding programmes are identified, particularly when policies target community-level socio-technical transitions to address global challenges.

**Keywords:** transformative R&I policy; research funding; socio-technical transformation; climate change; joint programming initiative.

## 1. Introduction

Research and innovation (R&I) policy has evolved in recent years towards a fundamental transformation of industrial societies and economies (Weber and Rohrer 2012). Shifting from pure economic interests and narratives of growth and competitiveness (Kallerud et al. 2013; Diercks, Larsen, and Steward 2019; Ghosh et al. 2021) towards addressing societal challenges and promoting sustainable development is considered a new paradigm (Aagaard, Norn, and Stage 2022). The complexity of these challenges has been translated into targeted policies that concentrate on specific missions supporting 'sustainable solutions' (The Lund Declaration 2009; Aagaard, Norn, and Stage 2022). In this vein, established innovation policies are complemented by new thinking and approaches to policy-making (Gassler, Polt, and Rammer 2008; Boekholt et al. 2010; Diercks, Larsen, and Steward 2019; Haddad et al. 2022) under rubrics, including mission-oriented policies (Mazzucato 2017), grand challenges, third-generation innovation policies, and transformative innovation policies (Schot and Steinmueller 2018; Diercks, Larsen, and Steward 2019; Haddad et al. 2022).

A major driver of these relatively new approaches to R&I policy and governance is the topic of Climate Change, as defined in the Paris Agreement (UNFCCC 2015) and the United Nations Agreement on the Sustainable Development Goals (SDGs; United Nations 2015). Policy models to address the global climate crisis can be described as 'mission-oriented' because they require specific targeted actions and steps to negotiate and tackle the problem (Gassler, Polt, and Rammer 2008; Mowery, Nelson, and Martin 2010). To date, research on climate change mitigation and adaptation has been based

primarily on natural science and technological and engineering approaches and solutions (Aufvenne, Egner, and Von Elverfeldt 2014; Fazey et al. 2018). Many scientific and technological contributions to the climate change challenge exist. The question of how to implement these, and to do so in a fair and just manner, remains unresolved and requires more 'concerted effort towards learning from and through action' (Fazey et al. 2018: p. 56).

This study is situated in the arena of the design and implementation of transformative R&I policies. The paper presents a case study of a policy-making practice that strives to induce or facilitate directed societal effects in the face of the global challenge of climate change, by funding a targeted research programme. The focus is the transnational European funding Call 'Enabling Societal Transformation in the Face of Climate Change' (SOLSTICE) of the Joint Programming Initiative (JPI)<sup>1</sup> Climate (hereafter the SOLSTICE Call or SOLSTICE). As a R&I policy instrument focused on addressing one of the grand challenges of our time through socio-technical transformation, SOLSTICE can be considered and analysed as a 'new generation' policy instrument (Boekholt et al. 2010; Kuhlmann and Rip 2018; Larrue 2021; Borrás and Schwaag Serger 2022).

The paper analyses how aspects of such new generation policy thinking may contribute to improving the design and performance of future transformative funding programmes, based on lessons learned from the SOLSTICE case. Section 2 summarizes the literature on transformative R&I policies and the relevant concepts operationalized in this study. Section 3 introduces the SOLSTICE case, and Section 4 presents the methods and data sources. Results are presented in Section 5,



needed to best support such implementation processes (Ghosh et al. 2021).

In their cross-national comparative study of four Grand Challenge-oriented R&I programmes in the Nordic countries, Borrás and Schwaag Serger (2022) found that ‘while many programmes are very ambitious, policymakers might have understood “transformative” in a loose manner, designing the instruments without being properly informed by theory’ (2022: p. 1). Other authors talk about a ‘mismatch between the theoretical ambitions and the translation of these programmes into practice’ (Ulmanen, Bergek, and Hellsmark 2022: p. 2) and that these kinds of policies ‘are transformative more in their rhetoric than in their design, implementation or evaluation’ (Schwaag Serger and Palmberg 2022: p. 144). There still seems to be a ‘gap between transformative goals and their actual implementation and operationalisation’ (Rohracher, Coenen, and Kordas 2023: p. 347). These examples refer to the (trans-)national level of policy design and implementation, and as of yet, evidence on local and regional levels is scarce. One element that is consistent across the current literature is that significant gaps exist between the theoretical literature and the practices of designing, implementing, and evaluating transformative R&I policies (Schwaag Serger and Palmberg 2022: p 181).

The contribution of this paper is to investigate precisely how the transformative character of new generation R&I policies is shaped and articulated. The paper uses SOLSTICE as a case study to map the entire process of designing and implementing a climate change funding policy instrument. Even though SOLSTICE has certain attributes that invoke academic transformative R&I policy thinking, it was formulated without reference to transformative innovation theory or literature. The case study thus examines how policy ambitions to generate socio-technical transformation were articulated and codified in SOLSTICE. It analyses how consonant these ambitions are with elements of the theories and concepts found in the academic literature. Rather than viewing theory and practice, policy coordination and experimentation, and top-down and bottom-up approaches as binary end points, it emphasizes the nuanced processual interplay between these concepts. In doing so, the paper also seeks to identify barriers to the design and implementation of transformative policies. By adopting a process orientation, the study thus provides insights into how R&I policies with transformative ambitions emerge and how a more theory-based and reflexive policy design process might improve and support policy outcomes.

### 3. Case study description

The transnational funding Call SOLSTICE—Enabling Societal Transformation in the Face of Climate Change—was established by the JPI ‘Connecting Climate Knowledge for Europe’ (JPI Climate). The European Commission’s Joint Programming process includes EU Member States (MS), Associated Countries, and Third Countries. On a voluntary basis, participants take part in research activities and programmes designed to tackle major societal challenges (Hunter et al. 2016). Currently, ten JPIs are working on different topics and challenges, of which climate change is one. Through the strategic development of transnational joint research agendas (hereafter Strategic Research Agendas, SRA), the JPI is one of the instruments for the realization of the European Research

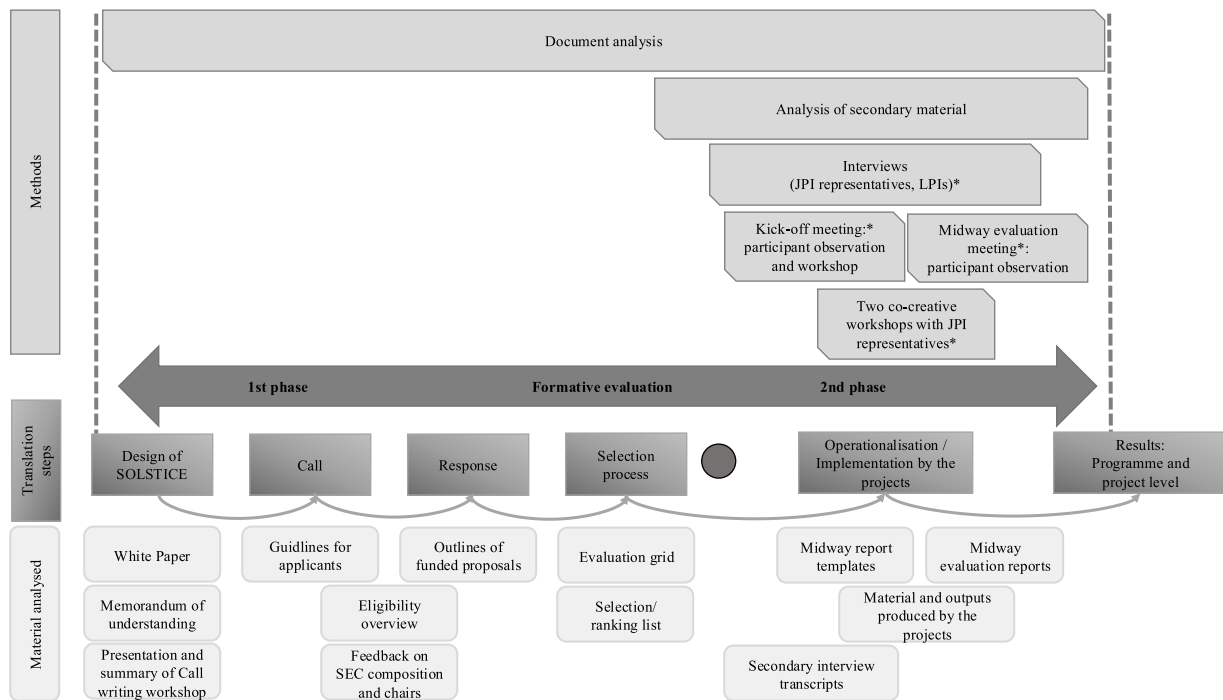
Area (ERA). JPI Climate involves nineteen MS and their representatives, including ministries for science and research, academies of science, scientific institutions, and agencies. JPI Climate’s operational and programmatic activities are implemented by task forces or action groups (AGs) in consultation with its Transdisciplinary Advisory Board (TAB) and then approved by the Governing Board.<sup>2</sup>

The action group ‘Enabling Societal Transformation’ (AG EST) initiated the SOLSTICE Call. Based on a previous call for transnational collaborative research projects in 2013<sup>3</sup> and a White Paper (West and Worliczek 2019), AG EST co-created SOLSTICE with scientific and policy stakeholders from participating countries.<sup>4</sup> SOLSTICE aimed to generate knowledge and expertise that will impact society and policy by enabling transformation in the face of climate change. SOLSTICE specified that ‘novel interdisciplinary collaborations across social sciences and humanities and potentially beyond are required’ (Call Secretariat 2019a), with social science and humanities (SSH) leadership of applicant consortia a mandatory requirement. Transdisciplinarity was also promoted, through the ‘engagement of societal actors in co-design and co-production...where appropriate’ (Call Secretariat 2019a). Launched in autumn 2019 and closed in February 2020, the Call followed a ‘1.5-stage deadline model’ that required applicants to submit an outline proposal for approval prior to a full submission (Göd et al. 2022).<sup>5</sup> In the end, seven projects received funding, to begin in spring 2021 and expected to end in winter 2023.<sup>6</sup>

### 4. Methods and data

This paper reports on a single, qualitative case study (Yin 2003) that combines traditional research methods with elements of a formative evaluation approach and a process evaluation strategy (Patton 1980). The case study is based on an information-oriented selection (George and Bennett 2005; Flyvbjerg 2006) building on knowledge of SOLSTICE and anticipated access to participants, stakeholders, and documents. Case studies have a distinct role in evaluation research (Yin 2003), and participatory and mixed-methods approaches have proven to be appropriate for assessing interdisciplinarity and knowledge translation between different levels of actors and spheres (Roelofs et al. 2019). A formative evaluation approach can entail co-creational components, comprise transformative innovation principles, and is suitable for different contexts (Molas-Gallart et al. 2021).

The longitudinal approach enabled the researcher to accompany a substantial proportion of the implementation of SOLSTICE. Research activities commenced shortly after the funding decision had been made (October 2020), but prior to the successful projects starting. Research activities continued until the original planned finish date for the projects (December 2023). Figure 1 shows the different methods and data used in this study. A process tracing method (George and Bennett 2005) commenced with the SOLSTICE design phase and continued until the mid-point of project implementation (the dashed lines in Fig. 1) and the preparation of this manuscript. A process-oriented approach was similarly applied to transformative innovation policies by Kroll (2019), who also emphasized the importance of the concept of translation to understand how strategic ambitions become concrete



**Figure 1.** Formative evaluation research approach\*.

\*Translation steps (shaded grey), material produced in the process of implementing SOLSTICE and gathered and analysed in the evaluation (light grey), research methods (grey). The circle marks the point at which the author entered the process.

policy measures. Process tracing identified a series of translations from the design of the Call, to the scientific community's response, to the initial phases of the funded projects. The projects are ongoing at the time of writing, and as such, their full results, outcomes, and contributions to societal impacts are beyond the scope of this paper.

As the author entered the process after the funding decision, information on the development of the Call, the Call writing workshop, and the selection of projects was gathered from analysis of secondary sources (Table 1), and exploratory interviews (Table 2). This marked the first research phase of the formative evaluation (Table 2). A review of the materials used to develop SOLSTICE provided initial insights into the policy design phase. In a parallel step, content analysis served to map the stated goals, objectives, and research content of each project proposal. Analysis of the proposals identified the (often implicit) anticipated project outcomes and the planned approaches for outreach activities designed to contribute to societal impacts. Together, these elements allowed for an understanding of how the research community responded to the transformative aims of the Call.

In addition, data were accessed from interviews ( $n = 17$ ) conducted as part of a concurrent Master's (MSc) degree project (funded by JPI and not related to the formative evaluation). Sharing of these data between the MSc research and the formative evaluation was indicated in the informed consent forms and processes with interviewees. Transcripts and preliminary summaries were made available confidentially to the author. Informal interviews and discussions of the preliminary results with the interviewer and JPI representatives were also part of data collection and served as a source of background learning and cross-validation. Data drawn from these multiple sources were analysed to identify prominent themes

**Table 1.** Secondary sources included in the analysis.

Publicly available	Confidential
White paper	SOLSTICE Memorandum of Understanding
Call guidelines for applicants	Presentation for Call writing workshop
Factsheets on funded projects	Summary of Call writing workshop
Scientific outputs produced by the projects (including websites, factsheets, publications, etc.)	Contact lists for participants in the SOLSTICE process
	List and feedback on SEC composition and chairs
	Evaluation Grid
	SOLSTICE eligibility overview
	Evaluation ranking list
	Secondary interview transcripts ( $n = 17$ )
	Midway report templates from earlier projects

that served as topics and prompts in the subsequent empirical phase.

The research initially explored the extent to which SOLSTICE was theory-driven in its design and development. Adapted to the outcome of this phase, a ToC was then co-created with JPI Climate to capture stakeholder expectations and used as a methodological tool to clarify the implicit logic of the SOLSTICE design. Two workshops (one online, one in-person) were held with JPI representatives, which served two main purposes. First, preliminary results were presented regarding assessment of the first translation steps. Second, joint learning and reflection involving the researcher and those responsible for JPI Climate helped establish a shared

**Table 2.** Timeline of research activities.

Research activity	Timeline
Analysis of secondary documents and other sources	Research phase 1 (10/2020–04/2021)
Exploratory interviews ( $n = 2$ ) with representatives from JPI Climate	
Participation and organization of a workshop session at the kick-off meeting	
Analysis of secondary interviews ( $n = 17$ )	
First formative evaluation co-creation workshop (online) with JPI Climate representatives	
Second formative evaluation co-creation workshop (in person) with JPI Climate representatives	Research phase 2 (05/2022–11/2022)
Interviews ( $n = 11$ ) with LPs and representatives of JPI involved in the design and implementation of the Call and evaluation of projects	
Analysis of written mid-term evaluation reports provided by funded projects	
Participation at mid-term meeting and presentation of interim results of the formative evaluation	
Analysis of project outputs	

understanding of the history, objectives, and evolution of SOLSTICE. In these workshops, ideas and concepts from transformative R&I policy thinking (Section 2) were also introduced and discussed with representatives of JPI Climate. The aim was to share some conceptual ideas on transformative policies and explain how the evaluation team would use them to interpret the funding process and its implementation.

In the second empirical phase (Table 2), interviews were conducted with people involved in the development of the Call, the proposal evaluation procedure, and the development and implementation of funded proposals (researchers). Interviewees included three representatives from JPI and all seven lead principal investigators (LPs) from the funded projects. All interviews were recorded and transcribed by the author.

The formative evaluation involved close collaboration and interaction with JPI representatives throughout the entire process. Research included invited participation in official and closed events and the development of additional activities involving the researcher and JPI representatives. Participation in meetings with JPI ( $n = 16$ ) included the SOLSTICE Kick-off, which contained a participative workshop session led by the author and joining the Interim Evaluation meeting organized by JPI. The latter involved providing feedback on the preparation and process and questions for the written mid-way reporting. Documents and presentations prepared for these different purposes were shared, including a summary of the interim evaluation analysis that was presented to the JPI Climate Governing Board. These activities were not only used to continue the evaluation but also to increase the stakeholders' awareness and understanding of the different steps in the process.

The main limitation of the research approach was that the formative evaluation, originally intended to be more constant and include more co-creative activities was significantly curtailed due to time demands, leading to a somewhat more standard evaluation approach being followed. As mentioned,

the researcher's participation in the SOLSTICE process started after the successful projects were selected. Therefore, the analysis retrospectively reconstructed the design phase. Nevertheless, the research benefited from a very high degree of access and willingness to cooperate with the evaluator among all stakeholders, including both policymakers and the research community. JPI representatives demonstrated a clear interest in the research collaboration, analyses, and results, especially in relation to relevant learning for potential future funding calls. However, no access was given to unfunded proposals, meaning that a broader evaluation of the response of the research community to the transformative ambitions of SOLSTICE was not possible.

Considering the previous research outlined and the contribution this study seeks to make, this paper addresses the following research questions:

- How does SOLSTICE seek to generate socio-technical change to address climate change?
- To what extent does SOLSTICE adopt or otherwise reflect transformative R&I policy and practice?
- In the SOLSTICE case, what obstacles can be identified to the design and implementation of transformative R&I policy?

These questions are addressed through the presentation of results in Section 5, followed by discussion in Section 6.

## 5. Results—two translations

This section reports the process of designing and implementing SOLSTICE as a series of two translations. These translations move from: (1) the policy idea to the design of the SOLSTICE funding instrument; and (2) from the response of the research community to the midway evaluation of funded projects. These translations overlap but frame a relatively straightforward sequential presentation of the study results.

### 5.1 Translation 1: from policy ambition to the SOLSTICE Call

The first translation was structured by a highly participative policy formation process that included several key milestones (Fig. 2).

The seed for SOLSTICE was planted in the Strategic Research Innovation Agenda 2016–2025 (SRIA) of the JPI Climate Governing Board, which identified that 'activities explicitly addressing the social and economic sciences and the humanities are considered a gap in climate change research' (JPI Climate 2016: p 18). In 2019, the JPI EST working group initiated the development of a policy White Paper (WP) entitled 'Operationalising knowledge on and for societal transformations in the face of climate change' (West and Worliczek 2019). This process involved representatives from nine participating European countries, with inputs and advice from the JPI Climate Governing Board and Transdisciplinary Advisory Board.

The WP promoted three epistemic dimensions—(1) social sciences and humanities driven, (2) interdisciplinary, and (3) transdisciplinary research—along with preferred outcome-focused approaches to underpin a coherent policy design to fill the research gap identified. The development process of the



The conclusion in the WP was to ‘recommend that the JPI Climate Governing Board includes requirements for transdisciplinary research in all future calls for proposals’ (West and Worliczek 2019: p. 2). However, following deliberations with funding agencies and administrative representatives, the requirements for integrating transdisciplinarity as a mandatory funding criterion in SOLSTICE changed.

We identified transdisciplinarity as a really important component and this is where, sort of some discussion we had in terms of whether to include transdisciplinarity or interdisciplinarity, you know, and we eventually went with the interdisciplinarity, and that was more to the choice of the funders ... if we added transdisciplinarity as a criteria that would limit projects that perhaps wouldn’t have that reach or that capability to go beyond their academic sort of focus. (Int\_2).

There were concerns that obligatory involvement of social actors might limit the scientific rigour of project proposals, and ‘impose’ something unwanted on them. In addition, institutional factors were an important influence, particularly eligibility and funding conditions.

So, then countries with very strict restrictions ... where we could not make stakeholder engagement or stakeholder participation a required criteria, an eligibility criteria, for submitting your proposal. Because in countries where they have very little funding opportunities for private sector or NGO’s or whatever (Int\_4).

The final SOLSTICE Call text recommended ‘engagement with stakeholders’ to generate creative and alternative ways to achieve impacts (Call Secretariat 2019a: p. 7). However, transdisciplinarity needed only to feature where researchers considered it ‘appropriate’ (Call Secretariat 2019a: pp. 7, 10). There was no guidance in the Call on how stakeholder involvement should be operationalized or at what point in the project research cycle this would be desirable.

Policy development leading towards SOLSTICE also focused on shaping desired project outcomes. Five thematic priorities described in the WP were the product of literature reviews, and the negotiation and integration of national research priorities. Continuing deliberation across the design process eventually saw three thematic priorities appear in the final Call: (1) Social justice and participation, (2) Sense making, cultural meaning and risk perception, and (3) Transformative finance and economy. The research community was required to direct their proposals to at least one of these priorities.

Contribution to socio-technical transformation was the overall expected outcome of SOLSTICE. Initially, societal impacts were not explicitly addressed, neither in the Strategy nor in the White Paper. However, during the deliberations and across the Call development process, it was repeatedly stated that ‘special attention’ should be paid to social impact. As this did not fit into the funding schemes of all participating national funding bodies, ways were requested to give more importance to this aspect and to find alternative ways to evaluate it.

Looking for something that’s quite robust and substantial in terms of, you know, the scientific quality of the ideas

and the sort of impact that it, you know, expects to have. Because this is where we are in terms of, you know, pushing society towards or accelerating the transition processes (Int\_2).

In the end, social impact was included in the guidelines for applicants; ‘to emphasize the importance of the scientific quality and impact of the proposals, these two criteria will receive a double weight’ (Call Secretariat 2019a: 11). What was meant by ‘impact’ in terms of societal outcomes was not explicitly defined in the design phase of the WP or the guidelines for applicants. Even though the description of societal impact in the guidelines primarily focused on dissemination strategies, open access, and outreach, it was also clear that the ‘impact should not be limited to scientific publications but should have the potential to trigger change in behavior and attitudes at any level of society’ (Call Secretariat 2019a: 7). The outputs and outcomes of the proposed projects were to be described in detail, but it was not required to specify how they were to be followed up or how they could create pathways to impacts in society.

Overall, the transformative ambitions of the SOLSTICE Call were embedded in epistemic requirements and guidance, and a preference for projects to plan for social impacts. By the finalization of the Call text, some of the ideas expressed in the WP had been moderated or left aside. The decisions taken about mandated criteria and preferred approaches likely had consequences for those who responded to the Call and the form their responses took. Theory and insights from transformative R&I policies were not part of and had no influence on this translation process.

## 5.2 Translation 2: the response of the research community and the selection and implementation of funded projects

The second translation involves three main elements, the response of research communities to the published SOLSTICE Call in the form of proposals, the process of evaluation and selection of grantees, and the initial phase of implementation of the funded Projects. The results presented here are based on analysis of successful project applications, interviews with the LPI of funded Projects, analysis of the mid-term evaluation reports, and participant observation in the kick-off and mid-term evaluation meeting. The interviews focused primarily on reconstructing the period of proposal preparation and secondarily on the early phases of Project implementation.

In response to SOLSTICE, the JPI Secretariat received 96 proposal outlines, of which 72 were eligible for funding and invited to submit a full proposal. Overall, responses to the Call were heavily focused on the social justice and sense-making themes (53/72). It was a concern to JPI that relatively few responses were received for the ‘transformative finance and economy’ theme, but an explanation remains unclear.

The evaluation of full proposals was a two-stage process. First, a remote evaluation by international experts from the field and, in the second step, a panel evaluation. It was important to those responsible for the selection of the panel that, besides scientific experts, representatives from the Transdisciplinary Advisory Board were involved to assess the planned societal impact.

That there really are also one or two people in there who specifically have the aspect of impact in mind, now not so much the aspect of excellence, but really look at how is this implementable and how can this reach into society. (...) We wanted different schools of thought to be represented and [an even distribution of] gender, geography, seniority, excellence versus application. (Int\_1). [author translation]

Evaluators were provided with an 'Evaluation Grid' for use in their assessment of Project proposals. The Grid was developed by the Call Secretariat and the AG EST, with feedback from the participating countries. The Grid included *interdisciplinarity* under the assessment of 'quality and efficiency of implementation'. Evaluation criteria were mixed under this rubric, and evaluators needed to balance their assessment of the interdisciplinary combination of the consortium with their evaluation of overall workload and gender balance. It remains unclear to what extent the mix and 'distance' of the different disciplines in the submitted proposals influenced the evaluation scores received.

In relation to *transdisciplinarity*, evaluators were asked to rank proposals on a continuum. This ranged from '[t]he proposal makes no attempts to involve non-scientific stakeholders where appropriate or justify their absence', which was rated as poor, to '[t]he proposal pushes the boundaries of transdisciplinary involvement, engaging non-scientific stakeholders in a highly synergetic manner' (Call Secretariat 2019b). Inclusion of non-academic partners was not mandatory, and no funded Project involved non-scientific stakeholders in the initial problem framing and the design of the projects. From the funder's perspective, this was not only unfortunate but also understandable in part due to institutional restrictions on eligibility for funding.

[M]ost proposals were talking about stakeholder engagement, but there is still no guarantee, that they will have an impact. It is easy to say, that you will reach out, but it needs to be successful. So, I think these people should be full partners as well. (Int\_5)

As access to the unsuccessful project proposals was not possible, it remains unknown whether the combinations of disciplines and integration of transdisciplinary partners described in these proposals were similar to those of the funded consortia or not.

Seven projects were selected and received funding totalling 6.9 million euros<sup>7</sup>, with all projects beginning in spring 2021 and funded for 3 years. Two projects were funded on the topic of 'social justice and risk perception', two on 'sense making, cultural meaning and risk perception', and three combined these two topics. Country partners in funded consortia included (LPs in brackets): Austria two (one); Belgium two (one); Czech Republic two; Finland three; France three (one); Ireland one; Italy three; Norway four (two); and the UK five (two), while no Latvian partner was funded. Table 3 shows the distribution of disciplines within funded SOLSTICE Projects. A wide range of SSH disciplines are included, while the only STEM disciplines to feature were various types of civil and environmental engineering.

Representatives from the funded projects considered a funding scheme specifically focused on SSH leadership on climate change to be an opportunity. The Call was valued

**Table 3.** Distribution of disciplines in funded SOLSTICE projects.<sup>a</sup>

Project	Participating disciplines
202 CM	Linguistics, anthropology, law & governance, social psychology
CCC-CATAPULT	Geography, environmental psychology, <b>environmental management</b> , social sciences, planning and urban geography, civil and environmental engineering, risk management and public and environmental policy, intercultural education (education & culture), civil and environmental engineering
CLEAN Cultures	<b>Sociology</b> , environmental/social psychology, economics, process engineering and environmental science, environmental engineering and environmental economics
JUST-Decarb Just-Scapes	Philosophy, <b>political science</b> , economics, law <b>Environmental SSH</b> (international development), geography, psychology, political science, futures studies, creative writing
ROLES <sup>b</sup>	Economic and human geography, urban studies and regional planning, behavioural economics and public policy, science & technology studies, environmental engineering and ecological economics
SOLARIS	Legal studies/private law, demography, geography/planning, <b>policy studies/political science</b> , water engineering, sociology

Source: Project proposals.

<sup>a</sup>Discipline of Lead Principal Investigator are given in bold.

<sup>b</sup>LPI is an interdisciplinary Professor working across energy, environment, and international development.

for opening this possibility, rather than the more typical orientation towards STEM in this area.

(...) especially in the field of climate, it's [funding calls] written for interdisciplinarity, but in fact, the lead partner is from ... Maths, from statistics, from biology to Earth to raw scientific fields. So, the idea that it's dedicated and leading by a social science partner was really something very interesting for us. (Int\_y3)

In their design, most Projects employ a relatively modular design, with disciplinary work distributed among the respective work packages and partners, starting with conceptual work, to empirical phases in case study formats, followed by a phase of interpretation and synthesis of the results and dissemination in the final project stage.

We can do something together, we can write together... I think that the project will have good results or... results..., even if the degree of interdisciplinarity is not so high. I think the three groups are developing interesting results. ...So I'm not an expert on that. I hope that this study day and other cooperation will develop our method and degree of interdisciplinarity. And, of course, this is a task of this last part of this year. (Int\_x4)

Most LPs had prior experience working in interdisciplinary teams and some relied on already existing contacts in assembling their consortia. During the first implementation phase, collaboration with disciplines that are relatively 'distant' was discussed as both challenging and fruitful. Some LPs reflected on the challenge of understanding the different languages of





LPIs also referred to the ‘reality’ that follow-up regarding the use or diffusion of project outputs beyond the project was unlikely to occur.

Whilst clear strategies for generating outcomes were not clearly formulated in the proposals, in their first implementation phase, projects engaged with a variety of non-scientific actors to different extents. Interactions occurred mainly in local place-based contexts, to co-create activities that contribute to the project’s objectives. These include diverse local stakeholder groups, from everyday users of technologies to experts within different sectors, from representatives of communities to schools (teachers, youth) and policy makers. Participative, collaborative methodologies, including hands-on workshops, T-labs (transformation labs), ongoing consultation processes, and other public and closed-door events, were envisaged to contribute to societal impacts.

Project leaders conceived cooperation with more ‘practice-oriented’ partners within their consortia as helpful in this regard, particularly for presenting research outputs less abstractly to improve their relevance to societal stakeholders.

And I think that was quite helpful at the end of the day because, in order to focus on the intervention and what we want to do with the people and then really formulate more concretely and not to break down from an insanely high and abstract level then directly to the practice and what we do practically. But to have a mediation level in it, so to speak. (Int\_x1) [author translation]

Such social impact focused actions were put into practice at the Project level. However, a trade-off between the specific demands of working with non-academic partners to generate societal impacts and the typical academic (career) pressure to produce publications from the projects was perceived to exist.

I feel that they also want to change something in public policy etcetera, but at [the] least they want articles. Yeah, so the time they have obviously, it’s not dedicated to solving this second question of, of transformative impact. It’s really in their heart. It’s really in their mind. They would like to do that so much. But they are really article-oriented in their choices, in their agenda ... in the time they give to the project. (Int\_x7)

It was argued that in general, but especially for the PhD students involved in the projects, it is important to publish *within* the project duration—and not to wait until all the results from the projects are available or the projects have ended.

Finally, during this phase of the research, ideas and concepts from academic work on transformative R&I policy were introduced to JPI Climate through interactions with the author. A programme-level (SOLSTICE) theory of change was presented at a workshop with JPI and used as an interpretive framework to discuss the key ideas and goals underlying SOLSTICE. Presentation of these ideas resulted in engaged responses on the part of JPI representatives and detailed discussions about the relevance of these ideas in this specific context. For example, providing a context for Projects to share experiences and learning was discussed as a potential programme-level ‘value-adding’ activity. This idea was taken up at the midterm evaluation in a discussion session on how Projects might upscale their outcomes.

## 6. Discussion

The stated ambition of the SOLSTICE Call was to generate research that would contribute to socio-technical transformation addressed to climate change. SOLSTICE focused on three epistemic elements—SSH leadership, interdisciplinarity, and transdisciplinarity—for creating new knowledge and shaping the intended societal outcomes of the funded projects (Haddad et al. 2022; Ulmanen, Bergek, and Hellsmark 2022; Haddad and Bergek 2023). It should be recalled that while SOLSTICE was designed with socio-technical transformation as its major objective, it was not consciously influenced by transformative R&I policy thinking (Smits and Kuhlmann 2004; Boon and Edler 2018; Grillitsch et al. 2019; Ghosh et al. 2021; Molas-Gallart et al. 2021; Haddad et al. 2022; Schwaag Serger and Palmberg 2022). However, the results show that the SOLSTICE design team developed a Call reflecting some characteristics of a ‘third frame’ R&I policy (Schot and Steinmueller 2018). First and foremost, the *directionality* of SOLSTICE reflects an essential objective of transformative R&I policies to not only shape what research is producing by publicly funded science but to also target specific domains and levels of future societal impacts with these investments (Lindner et al. 2016; Schot and Steinmueller 2018; Diercks, Larsen, and Steward 2019; Grillitsch et al. 2019; Aagaard, Norn, and Stage 2022; Borrás and Schwaag Serger 2022; Haddad et al. 2022; Schwaag Serger and Palmberg 2022).

As described in the previous results section 5, the initial idea of a funding programme that would integrate SSH with natural science and engineering interdisciplinarily in climate change projects was subject to debate and negotiation. This debate was largely concerned with not being too prescriptive about participating disciplines, whilst also wanting to attract those research communities not ‘typically’ involved in climate change related research. This dilemma was resolved by the decision to mandate interdisciplinarity and SSH leadership of project consortia, with the latter being a factor that was felt to have been very attractive by leaders of successful proposals. JPI Climate could not be certain how this strategy would be received by the research community in the projects designed to fulfil the ambition of SOLSTICE, but were willing to *risk engaging in this policy experimentation* (Smits and Kuhlmann 2004; Grillitsch et al. 2019; Ghosh et al. 2021; Borrás and Schwaag Serger 2022; Haddad et al. 2022; Howoldt and Borrás 2023).

The design of the projects resulted in multi- and interdisciplinary combinations that were mainly SSH-focused, tended to include relatively similar fields (medium disciplinary disparity, Table 3), and in most cases were experienced in climate change research. The response of the research community was thus not quite as radical as might have been hoped by the Call designers:

We knew that we wanted to have SSH working on the topic. We didn’t want to specify which kinds of disciplines should engage with each other, e.g. history and mathematics, but in the original idea, it was more ambitious (Int\_1)

Here, there is room to extend the radicalness of *epistemic boundary spanning* (Borrás and Schwaag Serger 2022) in a potential future iteration of the Call.



an undertaking, particularly for extremely busy officials with high-level policy-making responsibilities, and the feasibility of the method for internationalized research initiatives such as SOLSTICE. From the perspective of having conducted a less expansive formative evaluation process alongside SOLSTICE, these questions do have merit and probably need to be carefully considered by both policy scholars and policy-makers interested in such an approach. Following from this, parts of the process could only be analysed retrospectively, as the formative evaluation commenced when the proposal evaluation was completed, and projects were funded. Interviews were conducted with LPIs of funded Projects, meaning that the experiences of other consortium members were not fully discoverable. Finally, understanding of the research community's response to SOLSTICE was limited by the inability to access unfunded proposals submitted to the Call, due to data protection restrictions.

## 7. Conclusions

This study has investigated how an R&I policy with transformative ambitions was designed and implemented. It has analysed how addressing gaps between theory and practice may improve policy outcomes. Policy makers are increasingly interested in how their interventions can shape socio-technical change. At the same time, policy scholars are developing theories and concepts for the design and implementation of transformative research and innovation policies. As this study has shown, a gap exists between the practices of these two communities. The arc of transformative R&I policy ideas is envisaged to extend from initial policy designs to demonstrable societal outcomes. In the case of SOLSTICE, transformative ambitions were incrementally eroded by the complex and pragmatic demands of trans-national policy-making. The most significant barrier identified is the national-level criteria that limit the ambition of fully involving non-scientific partners and stakeholders as eligible project participants.

The process perspective applied in this study has shown that there are apparent opportunities to use transformative R&I policy thinking to support and enrich innovative policy-making with transformative ambitions. As the study demonstrates, policy makers were receptive to engaging with these principles to promote socio-technical change in the context of climate change. There was a willingness to collaboratively learn and experiment to improve the chances that their transformative policy ambitions could deliver desired societal outcomes in the future.

It appears evident that introducing theoretical thinking and practical evidence about transformative innovation would be more relevant if these ideas and concepts were discussed and debated in mutual exchanges with all stakeholders from the start of the policy design process. Integrating programme-level activities to provide in-the-run opportunities for researchers and projects to develop and adapt their understandings of these policy ambitions, how they might be achieved, and supporting them to learn and experiment also appear important here. In conclusion, building bridges between theoretical policy concepts and pragmatic policy design and implementation requires sustained engagement among all relevant actors.

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## Notes

1. [https://jpi-urbaneurope.eu/wp-content/uploads/2016/12/Joint-Programming-Initiatives\\_joint-brochure.pdf](https://jpi-urbaneurope.eu/wp-content/uploads/2016/12/Joint-Programming-Initiatives_joint-brochure.pdf)
2. <https://jpi-climate.eu/about-us/>
3. <https://jpi-climate.eu/programme/call-2013/>
4. The main authors from the JPI, Jennifer West and Elisabeth Worliczek, were supported by contributors from Italy, the Netherlands, Sweden, Ireland, France, and the UK, with inputs and advice from JPI Climate Governing Board and Transdisciplinary Advisory Board.
5. The draft proposals were used only as a tool for finding the appropriate evaluators and not as a basis for the final evaluation.
6. Five projects received cost-neutral extensions until mid-2024.
7. The 'virtual common pot system' (Call Secretariat 2019a) was based on the following maximum totals: Austria: 400,000€, Czech Republic: 500,000€, Finland: 700,000€, France: 1,000,000€, Italy: 500,000€, Ireland: 500,000€, Latvia: 300,000€, Norway: 1,000,000€, UK: 1,500,000€

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