Chapter 34

Pro-active reflexivity: advancing the science-for-sustainability agenda[69]

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Abstract

Supporting more sustainable development makes special demands on scientists, often requiring researchers to work in ways that differ qualitatively from the usual ways in which science works. In turn these requirements call for changes in science funding and management practices. Changes in science management and funding to better support scientists are needed both to "harness" science for sustainable development and to leverage the societal effectiveness of investments in science. This chapter describes the methodological approach of the recently-completed VISION RD4SD action (VISION for Research and Development for Sustainable Development) that was charged with raising awareness of the issue and developing appropriate responses. The chapter describes core outcomes of the action, including a set of guiding principles for science programme funders, developers, and managers, and a proposal for establishing a European platform for sustainability science.

34.1 Introduction

Reflecting on a recently completed research-and-support action funded by the European Commission, O'Riordan et al. (2015) highlight the great responsibility that lies with science policy makers and science funders in aligning their programmes to the growing challenges of unsustainability and in setting frameworks for research programme design, funding, and evaluation that take these challenges into account. The action was carried forward over the period 2010-13 under the acronym: VISION RD4SD (VISION for Research and Development for Sustainable Development).[70] It was motivated by concern to increase the effectiveness of investments in science and to harness science in pursuit of more sustainable development. ICIS was one of the main providers of research support to the action, whose partners included representatives of both the science policy making community and the sustainability science practitioner community. This chapter describes the methodological approach of the support action and its core outcomes.

34.2 Societal challenges of unsustainability

The wider policy, science policy, and science context is increasingly characterised by recognition of the growing number and urgency of major systemic challenges that societies across the globe are facing. These challenges are manifest in different ways in different contexts and at different scales, but they share common features. Their systemic aspect is especially important, since it is this that makes them largely immune to traditional approaches to finding solutions. Policy makers and scientists are increasingly aware that new approaches are needed to address these challenges and that, to be effective and efficient, solutions will need to be more holistic, systemic, and integrated, and developed in context together with the stakeholders concerned. This is indicated in the emergence of new styles of goal setting, policy making, and scientific support to decision makers and stakeholders.

Increasingly, policy goals are being set with reference to cross-cutting challenges. The focus within Europe on implementing the Europe 2020 Strategy, which aims at smart, sustainable, and inclusive growth, and the focus on addressing the grand societal challenges are in line with this general trend. So, too, is the effort at global level to define Sustainable Development Goals for the post-2015 period in relation to systemic

[70] In the course of reporting these core outcomes, the chapter makes reference to the evidence base that informed the recommendations. These include state-of-the-art reviews of science for sustainability in different countries or regions, illustrative examples of innovative and effective practices in the funding, management, conduct, and evaluation of science for sustainability, and several in-depth studies on specific challenges for sustainability science, such as interfacing. These are available on the action website: http://visionrd4sd.eu/

diagnoses rather than looking only at symptoms. More coherent approaches to policy making based on developing integrated policies that cut across hitherto separately addressed policy areas, such as poverty alleviation and habitat conservation, also reflect this trend. In order to support more coherent policy making, efforts are being made to provide more integrated scientific support. At the global scale, the new Future Earth project is working in this direction.

34.3 Science for sustainability

Problems of unsustainable development and societal challenges such as those outlined above are rooted in systemic failures, so they cannot be addressed successfully using specialised knowledge from any individual field. Also, both the problems and prospective solutions typically engage high stakes, vested interests, values, and uncertainties. A science for sustainable development that can take these aspects into account necessarily has to be different from conventional science, which is guided by rules and guardrails of specialisation, independence, controlled testing, replication, and peer approval by fellow scientists. Rather, a science for sustainable development entails working on problems in context with stakeholders and across conventional disciplinary and other boundaries, addressing problems through solutions, focussing on the bottlenecks of misunderstanding, incomprehension, and institutional brittleness, developing common understanding as a way of breaking through these, and using common understanding (rather than certainty) to agree on ways forward. Problems and solutions need to be managed adaptively through explicit experimentation. New inter- and trans-disciplinary knowledge will be co-produced in the process.

The needed science,[71] being very different from disciplinary science, makes special demands. It requires specific skills and associated research methods, tools, and processes for working across disciplinary boundaries, for engaging with stakeholders, for integrating knowledge, for producing new bodies of trans-disciplinary understanding, and for working towards transformative (systemic) change. But it is not only new scientific capitals and capacities that are required. There is a need also for more enabling framing conditions for science, including a deliberate sustainability orientation to science funding, new evaluation criteria for research proposals, projects, science organisations, and researchers, new forms of training and support for researchers undertaking sustainability-oriented science, and greater recognition and rewards for its practitioners, including enhanced career paths.

[71] The needed science is referred to variously by different groups and communities as Sustainability Science, RD4SD, and Interdisciplinary and Integrative Science, among others, but it has as a common theme the reconciliation of societies' development goals with planetary limits over the long term and the harnessing of science and technology in the quest for sustainability (see: Jaeger, 2009).

As O'Riordan et al. (2015) explain, there are examples of "tentative reaching out" by some pioneering research funding councils; but, for the most part, "researchers embarking on more integrative and imaginative procedures typically still face very considerable structural and methodological difficulties." Science for sustainable development [see Box 34.1] is therefore an emergent phenomenon that in the first instance is being supported by those who, in the words of O'Riordan et al., *"see its necessity and its intrinsic merits"*. Its champions "have to be prepared to experiment, to learn from failure, to understand and be sensitive to institutional bottlenecks, and to work progressively and cooperatively to overcome them" (O'Riordan et al., 2015).

Box 34.1 The Status of Science for Sustainability

Already, more than a decade has passed since "sustainability science" was established as a recognised research domain. The foundational work in the US and Europe (e.g. Kates et al. 2001; Clark, 2003; Weaver and Jansen, 2004) involved defining sustainability science in terms of main dimensions, characteristics, challenges, and distinctive features, and classifying it. Sustainability science is considered to lie in the category of "use-inspired basic research", the so-called Pasteur's Quadrant in Stokes' typology of science, and is regarded as "critical" science, as it challenges the status quo of prevailing development, policy, and scientific paradigms. Definitions emphasise its normative, systems-based, forward looking and transformative aspects and stress that uncertainty is an intrinsic feature of its subject matter.

Although sustainability science is now recognised as a research domain, its practices have developed through many disparate initiatives, carried forward by different scientists and scientific groups in many different contexts, often emphasising different methodological approaches, reference frameworks, themes, and perspectives. While the diversity and innovativeness of the scientists involved has led to experimentation with a wide range of tools, methods, and practices, the development has not been strategically coordinated or systematically and comprehensively studied and evaluated. Efforts among various small groups of practitioners reflect different topical interests. There is no overarching umbrella organisation bringing these strands together. The field is still characterised by fragmentation. There is therefore a lack of coherent evidence relating either to effective practices or to enabling framework conditions for effective practice.

(Source: Weaver, 2013, A European RD4SD Platform)

34.4 Methodological approach

Within this context VISION RD4SD was a joint effort by a network of 30 science policy partners and observers from 18 different European states supported by members of the community of European sustainability science practitioners. Together the action participants engaged in a dialogue aimed at exploring, collaboratively, the kinds of science that will be needed to support society in addressing the challenges of unsustainable development and in outlining practical steps that the two communities – science policy makers on the one hand and sustainability scientists on the other hand – can take to harness science for sustainability. The support action took a European perspective and was oriented primarily towards science policy making and research funding and management agencies of EU Member States, many of which were partners in the action. The action was contextualised nevertheless on a wider canvas of the widespread challenges of unsustainability that span multiple scales from global to local and affect societies everywhere, albeit differently and with manifestations that are context-sensitive. The support action therefore has a wider than European significance and its processes, methods, and outcomes are relevant for science policy makers, science funders, and science managers everywhere. They are relevant also for the global community of science-for sustainability-practitioners.

The core of the action was a structured dialogue among the science policy makers, funders, and programme managers. This was organised broadly along the lines of the methodology of Integrated Sustainability Assessment (Weaver and Rotmans, 2006; Rotmans et al., 2008) with repeated steps of scoping, envisioning, and pathway definition, each step being taken twice as part of an iterative sequence to allow also for evaluation, reflection, and adaptation. Scoping involved developing a joint understanding of the scope of the topic and the related problems. Envisioning involved developing a joint vision as a long-term orientation. Pathways involved exploring possible solutions, options, and science policy instruments to address the problems and realise the vision. Participants in this flexible and open forum exchanged experiences and developed a joint understanding of the status quo of science for sustainability in Europe. They identified challenges in undertaking this type of research, gaps in current practices, as well as opportunities for the way ahead. Regional and country case studies were undertaken by the supporting practitioners to provide participants with up-to-date information about the state of European science for sustainability, both in management and in practice. An overarching outcome of the dialogue was a joint vision on how to harness science for sustainability in Europe as a mid- and long-term orientation with strategies and road maps for joint EU-wide action as well as initiatives on research management reform processes to be implemented in the Member States. Recommendations were made also as input into the integration of science for sustainability in Horizon 2020 and for the realisation of the 2020 ERA Vision.

34.5 Vision and principles

At the heart of the vision of the role of science in supporting European sustainable development over the period to 2025, which was developed through the dialogue [see Box 34.2], is the objective to improve quality of life in Europe and globally. Global cooperation, transformed practices, good governance, and new ways of organising and implementing science and policy along systemic lines – with sustainability as a general orienting principle for science – are identified elements of the needed transformation in society and in the economy.

Box 34.2 The VISION of the RD4SD Action

The improvement of quality of life lies at the core of policies dealing with science and innovation. In 2025 Europe is a catalyst and a world frontrunner of global cooperation towards this aim. In an era of growing complexity, in which there is an increasing ambition to live in a more secure, democratised and open world, there is an urgent demand for transformative but informed practices supported by good governance. New forms of organising and implementing science are based on novel ways of societal collaboration and trans-disciplinary knowledge integration and understanding. Implementing this vision requires a systemic approach in science and policy and, especially, new criteria and procedures for assessing scientific excellence. At its best Research and Development for Sustainable Development (RD4SD) will support decisive changes in individual behaviours and collective values and policies to transform our economy towards one that is sustainable and focused on addressing today's and future societal challenges and responsibly meeting the needs of all humankind.

Against the backdrop of this shared vision, the VISION RD4SD action articulated a set of eight principles to guide those involved in developing science policy or in designing, funding, or managing research programmes with a sustainability orientation. These comprise:

1. *Joint Agenda Setting in Research Programmes*: Research, development, and innovation programmes must be defined in collaborative processes that ensure the societal long-term ownership of science processes and products. Therefore RD4SD must be designed to allow for effective engagement of societal actors from business, industry, government, and civil society to identify the problems of unsustainability that should be addressed.
2. *Co-design, Co-production, Co-delivery and Co-interpretation in Projects*: Open funding procedures are needed for projects that engage stakeholders in the framing of the research and that allow, in a spirit of cooperation, the full integration of

knowledge and experiences of stakeholders as well as joint interpretation and communication of the results.

3. *Flexible and Adaptive Programme Management*: A great degree of flexibility and creativity is required in the management of RD4SD. For instance, pre-funding of research can ensure the formation of inter- and trans-disciplinary teams. Funding of separate, explicit phases of RD4SD – a scoping phase, an implementation phase, and a winding-up phase – can lead to a robust process that successfully addresses the intrinsic normative, complex, goal-searching, and participatory nature of RD4SD.
4. *Adapted Evaluation*: New approaches for proposal and project evaluation are required, since co-design with stakeholders means that problems and societal challenges need to be clarified ahead of and as a basis for all following R&D. Additional criteria for evaluation are needed, in particular to emphasize the societal relevance and need for outreach in RD4SD, since high scientific quality will not be enough. Furthermore, learning within projects has implications for mid-term project evaluation. Credit must be given for designing and running participatory, integrative processes.
5. *Systemic Approaches*: To tackle societal challenges, RD4SD needs to incorporate new trans- disciplinary perspectives that yield more complex analyses on the interactions of socio-ecological processes that occur at multiple scales, both in time and space. This entails more integrative, holistic, and cooperative approaches to R&D both in science and policy and a long-term perspective that includes the impacts of R&D on the welfare of future generations. An emphasis is needed on taking systemic perspectives and using methods that can better address complexity, trade-offs, multiple scales, non-linearity, and inherent uncertainty.
6. *Communication, Empowerment, Engagement, and Exploitation*: RD4SD findings must be accessible, accountable, and meaningful for diverse audiences to participate in, and actually empower them in their production. This means opening new opportunities for laypersons and many other often neglected voices to be involved in the implementation of integrated, systemic, and fairer solutions to global challenges. The knowledge to be elaborated through RD4SD needs to be socially and ecologically robust. This process of co-creation, co-delivery, and co-interpretation requires special facilitation, interfacing, and empowering skills that must be supported through project funding.
7. *Career Opportunities and Recognition*: To build up a solid new generation of experts in RD4SD, there is a need to provide career opportunities for both inter- and trans-disciplinary researchers. Academic institutions must give credit for challenging, complex projects and for designing and running dialogues and participative, integrative science-for-society processes. Reward systems in academia for inter- and trans-disciplinary research must be established and made attractive and transparent.
8. *Capacity building*: Harnessing RD4SD needs ongoing capacity building for funders and practitioners via training, a forum for exchange of experiences, and easily

available documentation of good practice. Management of transformative processes, system-oriented perspectives and inclusion of learning cycles, as well as positive leadership competences, are key elements of these capacities and their respective capacity building.

34.6 Towards a Platform for Experience Exchange

Through the dialogue process, participants to the action recognised that to meet the aims of the Europe 2020 Strategy and to address the grand societal challenges, a different kind of science will be needed as a complement to usual forms of disciplinary science: a science that responds to societal needs, is sensitive to context, is impact-oriented, and is transformative. It was recognised that the need for this new science is made more urgent by the economic and financial downturn, which also requires that the new science is practised efficiently as well as effectively. The action nevertheless highlighted that the integrating, interfacing, and transformative aspects of science for sustainability are particularly challenging for researchers and that significant gaps, both quantitative and qualitative, remain to be filled in existing scientific capacities in respect of how best to perform these functions. A recommendation, therefore, was to develop activities for building and strengthening science-for-sustainability capacities in Europe on a continuing basis and for developing a consistent reference framework for the practice of science for sustainability.

The action therefore makes the case for a formalised effort to learn systematically from science-for-sustainability experiences by identifying more and less successful practices and by studying factors (both contextual and methodological) that influence outcomes. There is opportunity for this. Different research approaches are being developed and deployed under different science policy frameworks, in many different contexts, and using many different methods, tools, and processes. So far, however, although there have been some small-scale studies to evaluate particular experiences, there has been no large-scale systematic effort to compare, consolidate, and integrate different approaches or to adopt a more strategic experimental design to examine and learn from these real-life “experiments”. A systematic effort would involve deployment of a consistent evaluation methodology to undertake comparative and meta-analysis of a wide range of case studies that represent different contexts, methods, and outcomes. Such an effort is needed to establish a reliable evidence base and to contribute to delivering a validated conceptual and methodological framework for the design, management, and evaluation of future science-for-sustainability programmes and projects. Ideally this effort should be on a continuing basis to provide for on-going experimentation, evaluation, learning, standard-setting, and improvement.

Continuity would also provide opportunity to develop a permanent basis for the performance of associated tasks and activities that are important for quality control and for establishing credibility and reputation for science for sustainability and its practitioners. The VISION RD4SD action recognised at least six candidate functions for a permanent science-for-sustainability platform:

- providing a stimulus for innovation and creativity;
- maintaining an accessible, interactive (web-based) structured repository of science-for-sustainability resources (a one stop-shop or clearing house function);
- facilitating open conferences, dialogue, reflection, learning, exchanges (of experiences, personnel, and resources from around Europe and around the world), transfer of good practices (and adaptation to context), and the development and consolidation of a community of good practice;
- establishing a pool of expertise and practical and policy advice for effective cooperation;
- training and capacity building in key skills and qualities required of science for sustainability;
- forming a European focal point for international (global) cooperation and exchange, potentially serving as a hub for a network of networks.

The development and implementation of such a facility would involve actors from the practitioner communities, science policy makers and funders, business, and civil society. It could take on any of several different organisational forms, including that of a physical or virtual competence centre, a network of excellence, a programme, or a platform. There is also the possibility of establishing a network of excellence involving a set of European national or regional centres working together through a joint programme of activities. The needed functions could therefore be performed by creating a new organisation or network or by integration into existing organisations or networks. The VISION RD4SD action suggested a European platform, but there is also the possibility that a European platform could be part of a broader international or global initiative and act, for example, as a regional hub in a global network. A European facility could, conceivably, also begin or coordinate a global initiative.

In this last respect, the VISION RD4SD action, importantly, is not alone in recognising the need for context-sensitive research into science-for-sustainability practices and their effectiveness. A recent report to the United Nations Office on Sustainable Development (UNOSD) acknowledges that: “the nature of knowledge and, with it, sustainable development knowledge is changing” and that “this has profound implications for the practice of sustainable development and for the process of building capacity to implement it” (UNOSD 2012). It states further that: “these changes combine with the emergence of networked governance, increasing the importance of boundary work, facilitation and mediation; and these underscore the need for UNOSD to develop its knowledge sharing, capacity building and networking activities and provide suggestive guidance for this development”. The report recommends, inter alia, that UNOSD develop (or identify) new, specialised tools and methods for knowledge management and implementation of sustainable development, help build capacity for managing and participating in networked governance, and train people on effective boundary work, which the report defines as involving managing the interfaces between science, policy, and stakeholder groups and building strong networks among the people in these groups.

The European Science Foundation Member Organisation Forum on Science-in-Society (ESFMOF SiS) has also recently concluded that Science-in-Society activities need to be analysed by research. “The embedding of Science-in-Society in diverse cultures is a fruitful field of research. A common European view on Science-in-Society and its practices needs to be elaborated with simultaneous consideration of the diversity of local and national contexts and situations… The definition and design of European science policy cannot be divided and managed only through thematic societal challenges and disciplinary actions. There is a need for an exchange of practices as well as themes from an academic point of view at European level and this might be one of the places where exchange could be developed across the globe” (ESF MOF Science in Society, 2012, pg. 26.) This last remark is also especially pertinent, since it points to the potentially greater value that could come if a European effort is part of a global effort.

In her recent book, Bammer (2013) also comes to similar conclusions about the need for a new style of science, the tasks involved in implementing this new science, the core competencies that are implied, and the need for reflexive processes so that lessons from practice can be used to inform future practice. Bammer calls this new style of science “Integration and Implementation Science (I2S).” She structures the needed competencies into three domains and, for each, reviews the state of the art. The three domains she identifies are: synthesising disciplinary and stakeholder knowledge, understanding and managing diverse unknowns, and providing integrated research support for policy and practice change. In a prospective section of her book, Bammer outlines a virtuous cycle between capacity, demonstrated success, and funding, which focuses on capacity building through reflexive evaluation.

34.7 Evaluation

Learning from experience is essential for competence building. This requires a dynamic and continuous interplay between past, present, and future practices mediated through reflexivity based on systematic evaluation, in context, of a diversity of science-for-sustainability programmes and projects in order to highlight general principles and distinguish these from factors that are context-specific. Evaluation – to establish which practices are successful and in which contexts – is key to identifying good practices and developing and spreading core competencies, just as it is for designing and evaluating research programmes and assessing research impact.

Approaches to evaluation and valuation (e.g. social valuation) of research and research outcomes have, therefore, become important topics of innovative R&D on the part of science policy makers, science funders, and scientists in the science-for-sustainability domain. Several research funding organisations have instigated work recently on methods and schemes for evaluating sustainability-oriented transdisciplinary research and on how to value its outcomes and impacts, including process outcomes when more tangible outcomes are not yet evident. At European level such organisations include the European Foundation Centre, the European Science Foundation, and the European Commission. At Member State level several national agencies have initiated studies into possible evaluation methods, such as the German Federal Environmental Protection Agency and Research Councils UK. A review of these initiatives and the approaches they have developed was undertaken by ICIS for the VISION RD4SD action and is available on the action website (see: Weaver, 2013, RD4SD-relevant evaluation practices).

In principle, those who have engaged directly or indirectly in organising, funding, or contributing to developing methods and schemes for evaluating science-for-sustainability activities are also candidate stakeholders in competence- and capacity-building initiatives, such as those proposed by the VISION RD4SD action.

34.8 Concluding remarks

Above all, the present chapter illustrates the need for self-reflection – or reflexivity – on the part of those involved in science for sustainability with respect to constantly examining the compatibility of the prevailing science policy framework with the special needs that science for sustainability implies, as well as evaluating the effectiveness and impact of research designs, the methods and approaches that are deployed in projects, and how the methods used are combined and tailored to the specifics of application contexts. It illustrates, also, the contribution that the Maastricht University and ICIS specifically is making to this process of constant improvement through initiatives in which it is involved, of which the VISION RD4SD support action is but one example.

The VISION RD4SD action has already had direct impact on its participants. The progress of the action was closely followed also by science funding and management organisations across Europe and more widely. Outcomes were posted on the action website as they were produced. Download counts for the main deliverables were running at several thousand by the time the three-year action had completed. In the short and medium terms such reflexivity is helping to secure improved framing conditions for science for sustainability and is helping to disseminate and upscale good and effective practices. In the medium to long terms this should help increase the relevance of projects, and leverage the positive societal impact of efforts across the wider corpus of science for sustainability. It has been suggested that this could also deliver spin-off benefits for impact-oriented science more generally, as science for sustainability is a front runner in making societal impact the touchstone of science efforts.

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