7 The dynamics and long-term effects of multi-actor research programs

7.1 Brief summary

This dissertation started with the observation that multi-actor research programs are an increasingly popular form in which to organize scientific research. Multi-actor research programs link their research agendas to the grand challenges that contemporary societies face. Participants from different disciplinary, organizational and sectoral backgrounds are encouraged to collaborate on topics such as climate change, ageing society and food security. The resulting collaborative research practices should be sustained beyond the programs’ lifespan in order to make science systems more responsive to these grand societal challenges.

Although multi-actor research programs are increasingly popular, there is not a lot of clarity on their organization and effects. For example, a systematic understanding of how these programs provide non-academic stakeholders with a role in scientific knowledge production is lacking. In addition, it is difficult to assess the long-term effects of these programs due to attributional and temporal issues. To fill these knowledge gaps and to strengthen the use of these programs as policy instruments, this dissertation raised two central questions:

- How do multi-actor research programs organize collaborative research practices?
- Do multi-actor research programs have long-term effects on scientific knowledge production?

To answer these questions we focused first on the organization of collaborative research practices and subsequently on the programs’ long-term effects. Nine sub-questions were identified at the start of the dissertation. The answers and conclusions to these sub-questions are summarized below.

7.2 Collaborative research practices

Multi-actor research programs are expected to organize collaborations across disciplinary, organizational and sectoral boundaries. In this dissertation, the focus was on collaborations between participants from different organizational and sectoral backgrounds. In other words, collaborations between researchers from different disciplines were not studied in the context of this dissertation. For interesting studies on this aspect of multi-actor research programs see, for example, the work of Lyall and colleagues (Lyall and Fletcher 2013; Lyall et al. 2013). Our main findings and conclusions on collaborative research practices are summarized below.
7.2.1 Cross-organizational collaboration
The consortium approach of multi-actor research programs is seen as a means to organize collaborative research practices between organizations. In the literature, it is often assumed that the involvement of a consortium of organizations will result in what is known as ‘network coordination’. Multi-actor research programs have readily been understood as a manifestation of a process of ‘delegation to networks’. However, empirical studies of the actual coordination approaches of network organizations have been limited. Chapter 2 raised the following two sub-questions:

1. What actual coordination approaches do multi-actor research programs develop?
2. How can we explain the development of a certain coordination approach?

A systematic comparison of the actual coordination approaches of two Dutch research consortia showed that multi-actor research programs do not necessarily develop a network coordination approach. The two programs studied in Chapter 2 – Climate changes Spatial Planning and Next Generation Infrastructures – did apply network coordination attributes, but only to a limited extent and mainly in combination with other coordination attributes. Moreover, the coordination approaches of the two programs differed substantially. The case studies indicate that ‘delegation to networks’ as applied by multi-actor research programs is not an undifferentiated form of research coordination. The development of a certain coordination approach seems unrelated to the challenge-driven focus of a program. Internal consortium characteristics (such as the number of consortium partners and the relationships between them) appear to have the greatest influence on the development of a coordination approach by the consortia.

7.2.2 Cross-sectoral collaboration
Collaborations across sectors are expected to be stimulated by giving non-academic stakeholders a role in the knowledge production process. At the start of this dissertation, we identified two main gaps in the understanding of stakeholder involvement in multi-actor research programs. First, previous studies had already shown a wide variety of stakeholder activities in different parts of these programs, but a more systematic understanding of stakeholder involvement at different organizational levels and the links with research activities was lacking. Second, the diversity of possible stakeholder roles meant it was unclear which consortia policymakers should select in order to achieve the desired collaborative research practices. We subsequently raised the following four sub-questions:

3. What roles do stakeholders play at the different levels of multi-actor research programs?
4. How are these different roles linked to the research activities in multi-actor research programs?
5. How are stakeholders involved in the design phase of a multi-actor research program?

6. To what extent is such involvement a predictor of their later involvement and financial contribution?

Chapter 4 addressed the first two sub-questions. A typology was introduced based on a combination of three dimensions: (1) the direction of the flow of information between scientists and stakeholders, (2) the phase of the research process in which stakeholders are involved and (3) the nature of their contribution to the process. Application of the typology on climate adaptation programs in the US, Germany and the Netherlands confirmed that stakeholders play diverse roles in multi-actor research programs. By comparing programs in terms of the involvement of stakeholders at the various organizational levels, we identified different ways of linking stakeholders to the processes of scientific knowledge production: in the RISA program (US), research activities are driven by the involvement of individual stakeholders who express their needs at the detailed project level; in the KLIMZUG program (Germany), the cluster level serves as an interface for two separate pillars of projects (networking projects and research projects); and in Knowledge for Climate (the Netherlands), research starts with contributions of stakeholders at the most aggregate level which then trickles down to lower, more detailed organizational levels. Every approach to the organizing of stakeholder involvement has its strengths and weaknesses. Our typology provides policymakers with an instrument to shape involvement in alignment with the overall policy aims. Further research is needed, however, into the effects of different approaches on program output (scientific and societal) (see the discussion in 7.4.3).

Chapter 5 focused on sub-questions 5 and 6 about selecting a consortium that will actually carry out collaborative research activities beyond sectoral boundaries. The study of 37 Dutch multi-actor research programs revealed that involvement in the design phase ranges from full involvement as part of the writing committee to no contribution to the program proposal at all. We subsequently found significant correlations between the degree of user involvement in the design phase and their involvement in decision-making at various program levels while the research was being carried out. The actual financial contribution of knowledge users correlates quite strongly with their intended contribution, as promised in the consortium proposal. In general, our findings suggest that ex-ante evaluation based on stakeholder involvement in the design phase is a possible and legitimate means to select consortia for multi-actor research programs. Governments aiming to stimulate cross-sectoral collaborations should select them on the basis of the degree of user involvement in the program design and the intended financial contribution.

7.2.3 Facilitators of collaborative research practices

The comparative case studies in Chapters 2, 4 and 5 revealed that there are large differences between multi-actor research programs in terms of the way they
organize collaborative research practices (see e.g. the quite different coordination approaches of the two Dutch multi-actor research programs described in Chapter 2). At first glance, these findings suggest that there is no single typical multi-actor research program approach to organizing collaborations beyond organizational and sectoral boundaries. It is important to note, in this respect, that differences between programs are not necessarily due to different ideas about addressing societal challenges. The main differences between the multi-actor research programs studied appear to be related to either internal consortium characteristics (Chapters 2 and 5), such as the network composition of a consortium at the outset, or context characteristics related to national culture or the science system (Chapter 4, and see also Chapter 6), such as the level of controversy in a country about the issue of climate change.

However, in addition to differences between cases, this dissertation also revealed large differences within cases. For example, innovative and ambitious ways to involve stakeholders were found alongside traditional (Mode 1) research projects. Despite transdisciplinary objectives, traditional stakeholder roles, such as being informants and recipients, were still among the three most frequently occurring roles in the RISA, KLIMZUG and Knowledge for Climate programs (Chapter 4). Interviews with participants of the programs confirm previous studies on collaborative research practices that have found that participants often observe obstacles created by home institutions and other formal and informal institutions (such as evaluation schemes for scientific researchers) (Boon et al. 2014; Feldman and Ingram 2009; Jacobs 2002; McNie 2007; Turnhout et al. 2013).

This variety within multi-actor research programs and the dynamics observed in the interviews led to the conclusion that these programs share an organizational approach that stimulates collaborative research practices. Multi-actor research programs should be seen as ‘facilitators’ of collaborative research. Most of the effect of the programs studied on research practices is achieved by providing participants with opportunities to work in new ways, rather than by imposing and enforcing requirements. Most of the innovative examples of collaborative research practices in these programs come from participants who are intrinsically motivated and believe in this approach to grand societal challenges. By providing resources, network opportunities and a structure, multi-actor research programs do not make the above-mentioned obstacles disappear, but at least make them seem surmountable to such participants. A quote from a senior researcher from the NOAA RISA program is illustrative:

[In my regular research as a university professor I would do some of the work I do for [the RISA project] anyway, but the time to go out and meet and the travel funding and so on, to leave the university and go out and work with people and go to their meetings and so on. [...] I can go and see them and go to meetings [...], which I otherwise probably would not be able to go’ (NOAA RISA, Senior researcher).]
Hence, the findings in the chapters on collaborative research practices suggest that despite differences in organizational form a shared approach to organizing collaborative research does exist. Multi-actor research programs organize collaborative research by facilitating and providing motivated participants with opportunities to engage in activities that can be labelled as knowledge co-production, transdisciplinary research or post-normal science.

7.3 Long-term effects of multi-actor research programs
Multi-actor research programs are implemented with the ambitious objective of having long-term effects on the science system. The assessment of the long-term effects of research and innovation programs is a difficult endeavor. In this dissertation, we selected one important issue: the actual effects of these programs on the skills of participating PhD students, which were studied as an indicator of such long-term effects.

7.3.1 A new generation of PhD holders?
Multi-actor research programs create an environment for the professional and social development of large numbers of PhD students. These programs offer a different structure for PhD students, by defining different conditions and criteria for participation, formulating expectations in their missions and objectives, having a particular audience and involving a variety of participants. To assess whether this has an effect on the skills of participating PhD students, Chapter 6 raised the following three sub-questions:

7. Is the set of skills developed by PhD students in multi-actor research programs different from the set of skills developed by PhD students in traditional trajectories?
8. Are differences between training trajectories in skill development related to individual characteristics and to training context?
9. What is the relationship between individual characteristics and training context characteristics and the development of different types of skill?

To answer these sub-questions, a survey among 415 sustainability PhDs in both multi-actor research programs and traditional trajectories in the UK and the Netherlands was conducted. The survey covered questions on research practices and the development of four types of skill: (1) academic research skills, (2) academic communication skills, (3) translation and dissemination skills, and (4) transferable skills.

The comparison of skill development in multi-actor research programs and traditional trajectories in the UK and the Netherlands revealed no differences in academic skills but slightly higher dissemination, translation and transferable skills in multi-actor research program groups. A closer look at the individual and context characteristics of PhD students in the two trajectories showed that multi-actor research programs attract PhD students who have a more boundary-
less mindset and a broader set of skills at the start of their project, and that they work in a more multi- and transdisciplinary research context. However, differences between multi-actor research groups on context characteristics indicate that these collaborative training trajectories are not uniform. This is in line with the observation that multi-actor research programs are facilitators rather than organizers of collaborative research practices, in other words, these programs provide opportunities for collaborative research practices instead of imposing them.

7.3.2 PhD skill development and future research practices
Socialization during the PhD phase of a research career can have long-term effects on a researcher’s future working practices and future career path. Chapter 6 revealed that differences between groups of PhD students in multi-actor research programs and traditional trajectories in the UK and the Netherlands are small and not always significant. Does that mean that – via this mechanism – multi-actor research programs do not have long-term effects on future research practices? The answer to this question is twofold.

On the one hand, it has to be concluded that the effects of multi-actor research programs are smaller than what such programs aim for in their objectives and mission statements. Variety between and within multi-actor research programs on PhD training trajectories confirm the findings of the case studies in Chapters 2, 4 and 5. The empirical results of Chapter 6 indicate that large numbers of PhD students in multi-actor research programs experience socialization that is no different from the experiences of PhD students in a traditional training trajectory.

On the other hand, the analysis of skill development by PhD students also revealed that there are PhD students who are involved in collaborative research practices across organizational and sectoral boundaries. Once more, this is in line with the findings of the case studies on the organization of multi-actor research programs. By providing opportunities to work in collaborative ways, the programs facilitate PhD students who are intrinsically motivated, by providing them with a training trajectory that includes interaction with participants from other disciplines, organizations and sectors. Multivariate analysis revealed that such interactions do – apart from individual characteristics – contribute to the development of translation and dissemination skills, as well as transferable skills. By facilitating such trajectories for individual PhD students, multi-actor research programs do have effects beyond their own lifespan.

7.4 Limitations and future research
The approach of and studies in this dissertation have several limitations that provide directions for future research. Before drawing recommendations on the basis of the main findings of this dissertation, this section discusses three limitations and suggestions for future research.
7.4.1 From explorative research to theory building and testing

As mentioned in the introduction to this dissertation, multi-actor research programs are an increasingly popular organizational form for scientific research, but there is relatively little systematic understanding of their organization, dynamics and effects. This starting point resulted in two central research questions with an exploratory character: (1) How do multi-actor research programs organize collaborative research practices? and (2) Do multi-actor research programs have long-term effects on scientific knowledge production?

Because of the exploratory character of these questions, a case study approach was selected to answer most of the sub-questions of this dissertation. In addition, the studies build on theoretical insights of various sub-disciplines rather than on one overarching organizational theory of multi-actor research programs. This dissertation has taken some steps towards theory building, but many steps remain in relation to integrating theoretical components (e.g. on the relationship between organizational and sectoral collaborations) and ultimately testing these theoretical assumptions. In this respect, two strands of research appear to be most promising.

The analysis of the coordination of collaborative research practices revealed that network coordination of research programs is not an undifferentiated form of research coordination (Chapter 2). The comparison of two Dutch multi-actor research programs resulted in the conclusion that internal consortium characteristics determine – via the governance form – a consortium’s actual coordination approach. Firstly, this conclusion should be empirically tested in comparable studies to determine the external validity of this finding. Secondly, in order to increase the explanatory reach of this conclusion, additional in-depth studies are needed into the relationships between: (1) the internal characteristics of consortia and the chosen governance form and (2) the governance form and a consortium’s coordination approach. Together, these two research steps can result in a substantive, explanatory theory about the coordination approaches of multi-actor research programs.

The comparative studies of stakeholder involvement in multi-actor research programs revealed that the three programs studied use different approaches to stimulate cross-sectoral collaborations (Chapter 4). It is rather unlikely that the approaches to stakeholder involvement of all multi-actor research programs fit within these three models. Additional research is needed to take stock of other possible models of multi-actor research programs that link stakeholders to the processes of scientific knowledge production. Such research should result in a taxonomy of models that enables policymakers and program managers to select program proposals and research consortia with approaches to cross-sectoral collaborations that fit the overarching policy objectives.
7.4.2 Generalizability
The strong focus on climate (adaptation) programs in developed national science systems is a clear limitation of this study. The rationale for focusing on climate programs is that the environmental sciences have a rich history of collaborative research. This history provides a research setting that is to a certain extent mature (it did not start experimenting with this type of research only recently) and provides a rich population of programs from which to draw cases. The focus on national programs from developed science systems was chosen to reduce complexity. Multi-actor research programs are complex organizations with many dimensions and factors that potentially affect internal dynamics. An additional focus on international collaboration, for example, would have added additional – and at present unnecessary – complexity to the main research object; complexity that would have made the explorative research tasks even more difficult. However, to test the generalizability of the findings of this dissertation, future research is needed beyond the boundaries of focus chosen here. This requires studies of multi-actor research programs: (1) from scientific research fields with less collaborative research experiences, (2) from emerging science systems (e.g. China, Brazil, India) and less developed science systems (e.g. African countries) and (3) with participants from different countries (e.g. EU Framework Program projects).

7.4.3 Linking organizational forms to output indicators
One of the main findings of this dissertation is that multi-actor research programs differ in terms of organizational form. This triggers the questions: (1) What are the effects of organizational differences on the output of programs? and (2) What are the best organizational forms to achieve certain types of outcomes? These questions are beyond the scope of this dissertation, but deserve future research attention.

At present, interesting work is being conducted on the output side of multi-actor research programs. At least three strands of research can be identified in this respect: (1) research on the scientific output of these programs (Ingwersen and Larsen 2007; Koier and Horlings under review; Van den Besselaar and Sandstrom 2013), (2) research on the usability and societal impact of the knowledge produced in these programs (De Jong et al. 2012; De Jong et al. under review; Feldman and Ingram 2009; Kirchhoff 2013; Kirchhoff et al. 2013; McNie 2012; Merkx et al. 2012) and (3) research on the effects on participating organizations (e.g. organizational learning) (Boon et al. 2014; Crona and Parker 2012). The focus of these studies is either on specific parts of multi-actor research programs (e.g. Boon et al. 2014; Kirchhoff 2013) or on the program as a whole, without taking organizational differences between programs into account (e.g. Van den Besselaar and Sandstrom 2013, but see also Chapter 6 of this dissertation). Future research that links the findings on organizational differences with the work on the output of multi-actor research programs is therefore needed.
7.5 **Recommendations**
The current popularity of multi-actor research programs is an indication that these programs are likely to be an important part of the science system in the near future. The final part of this dissertation provides two distinct recommendations for the organization of future multi-actor research programs. The first recommendation concerns the selection and guidance of multi-actor research programs and is directly derived from the findings presented in the previous chapters. The second recommendation concerns the organization of collaborative research in the context of these programs. These are based on the studies presented in this dissertation, but also on additional observations, conversations and interviews conducted in the context of this research project (see e.g. Wardenaar 2013).

7.5.1 **Selecting, guiding and learning from multi-actor research programs**
Policymakers rely on multi-actor research programs because they can save on transaction costs and provide promising means to deal with the lack of scientific expertise among policymakers (Braun 2003; Lepori 2011). However, this dissertation shows that the selection, guidance and learning of these programs require more effort on the part of policymakers than is currently the case (Chapters 2, 4 and 5).

More time and effort spent on ex-ante evaluation of consortia compositions – and especially the role stakeholders have within a composition – will increase the likelihood that the consortium selected will contribute to the overall policy goal of addressing grand societal challenges. Three central questions have to be addressed during the selection procedure for a research consortium: (1) Does the consortium’s composition reflect the diversity of the community involved? (2) Is there sufficient stakeholder involvement in the design phase of a multi-actor research program? (3) Is there sufficient proof of the intention of stakeholders to contribute (financially) to the multi-actor research program?

The guidance of and learning about multi-actor research programs are interrelated. Experience with and knowledge of multi-actor research programs will enable program management to address the grand organizational challenge of coordinating these programs. However, due to the temporary character of these programs, learning within the context of one multi-actor research program is limited. In many multi-actor research programs, the wheel is subsequently re-invented by new directors and program managers (e.g. this is what happened in many of the Bsik programs described in Chapters 2 and 5). As policymakers oversee multiple programs, they can – and should – organize more systematic learning processes that subsequently provide lessons and good practices for new programs.

7.5.2 **Challenge-driven research should start with local problems**
Multi-actor research programs are implemented to address grand societal
challenges such as climate change, ageing society or food security. Collaborative research practices to address such challenges are most effectively stimulated by providing motivated participants with opportunities to work in collaborative ways (Section 7.2.3). However, interviews and conversations with participants revealed that a great deal of misunderstanding, confusion and frustration can occur within these programs. This may be due to the fact that many multi-actor research programs translate the overall challenge-driven objective into general requirements – that are inspiring for some participants but very burdensome to others.

At the start of individual projects, project members often have very different expectations. In line with the conclusion that multi-actor research programs are ‘facilitators’ of collaborative research practices, I propose an adage that can serve as an organizing principle for multi-actor research programs:

_start from a local problem, select the right people, provide proper organization, and subsequently contribute to solving grand societal challenges._

Different local problems require different approaches. A one-size-fits-all approach is not appropriate. Most crucial in this step is that the people who will work on the problem actually match with the characteristics and issues of the problem. Non-academic stakeholders should only participate when they have an actual stake in and concern about an issue. Academic participants should be motivated or believe in a challenge-driven approach to scientific knowledge production. In contrast to current practices in multi-actor research programs, it is important to spend more time and resources on selecting the right people, who want to and can do this work.

After the problem and the people are identified, programs should provide them with appropriate project organization. For example, in the case that no willing stakeholders are identified, do not force a knowledge coproduction process upon participants. An initial explorative study by academic participants could generate the necessary interest of stakeholders. A follow-up project can then be more interactive or transdisciplinary. In the case that stakeholder interest is not generated, it should be assumed that the topic is not yet ready to be studied in a transdisciplinary way. In addition, by providing the appropriate organization, programs can give much needed training and support. Many studies have revealed that the collaborative research approach is not a walk in the park, but an intensive and difficult process (Feldman and Ingram 2009; Jacobs 2002; Wardenaar 2013). Participants – academic and non-academic – can benefit enormously from such guidance and support. Relying on this adage as an organizing principle will enable multi-actor research programs to be more successful in facilitating participants and subsequently in organizing collaborative research practices.
7.6 References


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