

Froese, Anna; Mevissen, Natalie

Article — Published Version

Failure through Success: Co-construction Processes of Imaginaries (of Participation) and Group Development

Science, Technology, & Human Values

Provided in Cooperation with:

WZB Berlin Social Science Center

Suggested Citation: Froese, Anna; Mevissen, Natalie (2020) : Failure through Success: Co-construction Processes of Imaginaries (of Participation) and Group Development, Science, Technology, & Human Values, ISSN 1552-8251, Sage, Thousand Oaks, CA, Vol. 45, Iss. 3, pp. 455-487, <https://doi.org/10.1177/0162243919864711>

This Version is available at:

<https://hdl.handle.net/10419/200755>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

Failure through Success: Co-construction Processes of Imaginaries (of Participation) and Group Development

Science, Technology, & Human Values
2020, Vol. 45(3) 455-487
© The Author(s) 2019



DOI: 10.1177/0162243919864711
journals.sagepub.com/home/sth



Anna Froese¹ and Natalie Mevissen¹

Abstract

Participation is an important but little understood concept in science and innovation. While participation promises the production of new knowledge, social justice, and economic growth, little research has been done on its contribution to innovation processes at the group level. The concept of imaginaries can provide a window into these processes. Adopting a micro-sociological perspective, we examined the interplay between imaginaries of participation and group development within a long-term ethnographic observation study of an initiative, Energy Avant-garde, as it pursued the

¹“Science Policy Studies” Research Group, WZB Berlin Social Science Center, Berlin, Germany

Corresponding Author:

Anna Froese, “Science Policy Studies,” Research Group, WZB Berlin Social Science Center, Reichpietschufer 50, 10785 Berlin, Germany.

Email: anna.froese@wzb.eu

development of a decentralized, self-contained, and entirely renewable energy system in one German region. We scaled down the macrolevel concept of imaginaries to the group level. We found that group imaginaries are a resource for bringing order to a group and that a group is a resource for creating, operationalizing, revising, and sustaining imaginaries. We describe a “failure-through-success” story: while imaginaries initially promoted group cohesion, creativity, and productivity, in later stages, these effects were impeded by group dynamics. We therefore distinguish between process imaginaries and outcome imaginaries and conclude that, inherently, participation must be managed and employed at the appropriate stages to make valuable contributions.

Keywords

imaginaries of participation, heterogeneous innovation, energy transition, renewable energies, group creativity, co-creation

Introduction

Responsible Research and Innovation (RRI) implies that societal actors (researchers, citizens, policy makers, business, third sector organizations, etc.) work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs, and expectations of society. (European Commission; <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation> [last accessed March 1, 2017])

Participation has become a key word in the current discourse about scientific and technological innovation, a development based on the projection that such participation will lead to new, more responsible, and socially robust knowledge, well suited for addressing the “grand challenges” (European Commission 2013). Literature suggests that opening the knowledge production process for actors from outside research and development, including laypersons, leads to the democratization of science, economic growth, and increased social justice (Hippel 2006; Gibbons 2011; Callon, Lascoumes, and Barthe 2009). Scholars have referred to the call for greater public involvement as a “participatory turn” (Chilvers 2008) toward a new era of knowledge co-creation, expected to provide access to untapped bodies of knowledge, spark group creativity, increase the value of scientific and

technological advances in the public eye, and help connect producers and consumers (Pfothenauer and Jasanoff 2017a, 2017b).

The examination of imaginaries is regarded by various authors as a crucial component of participation in innovation processes, which can provide a window into the functioning of such practices of co-creation (Welsh and Wynne 2013; Saille 2014; Felt et al. 2016; Marris 2014; Moore 2018; Pfothenauer and Jasanoff 2017a, 2017b). According to Felt et al. (2016), “societal values, norms, and concerns enter the research process through the dense deployment of tacit collective imaginations (. . .). These imaginations describe attainable futures and prescribe the images of futures that should be attained” (p. 754; see also Jasanoff and Kim 2015). Imaginaries convey tacit rules of social interaction and serve as exemplars of how participation should be undertaken within heterogeneous innovation settings (Jasanoff and Kim 2015).

While imaginaries that address underlying social and political complexities are necessary for the implementation of new technologies (Moore 2013), scholars have devoted little attention to interplay between imaginaries and group development and on how different forms and interpretations of participation might evolve during knowledge co-creation by heterogeneous groups.

We focus on groups, because, at a time when problems are becoming increasingly complex, groups are gaining in importance. Combining the diverse expertise of heterogeneous groups is the key to finding solutions to multidimensional grand challenges such as climate change (Gibbons 2011; Rhoten and Pfirman 2007). Research suggests that interdisciplinary groups have a particular potential to generate unique discoveries and radical innovation (Hackett and Parker 2016a, 2016b). Science policy increasingly supports such settings, yet, for trans- and interdisciplinary settings to be successful, there are many prerequisites (Donina, Seeber, and Paleari 2017; Rhoten and Parker 2004; The National Academies 2005; British Academy 2016; Leahey, Beckman, and Stanko 2016).

Research on group development has to date focused on communication and interaction patterns, norms, rules, conflicts, leadership processes, and emotions (Tuckman 2001; Mills 1967) but has neglected imaginaries as tacit collective imaginations of an attainable future. Universalistic models of group development have not taken into account the influence of imaginaries, which are especially relevant in innovation processes (Pfothenauer and Jasanoff 2017a). In this sense, imaginaries capture local, cultural, and temporal aspects, which are essential within heterogeneous groups. The connection between imaginaries and group development might tell us how innovation processes could be better managed within these groups and how

they might be scaled up to have a larger impact in society. Hence, we focus on one highly innovative area, the renewable energy sector.

We conducted a long-term ethnographic study of a participatory initiative, Energy Avant-garde, which sought to develop a decentralized renewable energy system in a region in Germany. Tidwell and Smith (2015) and Moore (2013, 2018) examined the effects of imaginaries in fields such as energy policy. Moore explores the complexity of locally and globally connected energy systems (the DESERTEC project, founded in 2009, Desertec Foundation) as sociotechnical fields that combine technical aspects with issues of justice, activism, norms and values, regulation and political frameworks. The field of energy systems is thus especially suitable for examining complex participatory practices in innovation processes. Generally, these practices have been found to lead to the development of more implementable technologies (Moore and Hackett 2016; Saille 2014).

This article contributes to the existing literature by linking the development of imaginaries to group processes and by introducing the concept of group imaginaries. Whereas research has traditionally conceptualized groups as stable, static, and closed (Kozlowski 2015; McGrath, Arrow, and Berdahl 2000), we propose a dynamic perspective that allows us to study the complexity and multilevel nature of group behavior. Imaginaries can influence group formation and support goal attainment, group cohesion, and creativity. At the same time, imaginaries are shaped by group development. This article advances the concept of imaginaries by making a distinction between process and outcome imaginaries.

We conclude with what we call “failure through success”: imaginaries can unleash different effects in different phases of group processes. Initially successful group imaginaries can impede goal achievement in later phases. We therefore suggest that the process of goal achievement might be very complex and require management to make a valuable contribution.

Theoretical Background

The purpose of this article is to integrate two hitherto disparate literature strands: science and technology studies (STS) and literature on group processes.

Imaginaries of Participation

We take the concept of sociotechnical imaginaries (Jasanoff and Kim 2015) as a theoretical starting point for examining the role of participatory

processes in group development. They are defined as “collectively held, institutionally stabilized, and publicly performed visions of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology” (Jasanoff and Kim 2015, 4). They are “collective, durable, capable of being performed; yet they are also temporally situated and culturally particular” (Jasanoff and Kim 2015, 19).

Such imaginaries play a crucial role in energy policy because they show how different nations envision their future and the risks associated with this future (Jasanoff and Kim 2013). Studying energy transitions can hence reveal conflicting imaginaries associated with changes in sociotechnical infrastructure as there are many different actors involved (Moore 2013, 2018; Moore and Hackett 2016; Canzler et al. 2017b).

In this sense, imaginaries of participation may be particularly important in energy policy and reflect recent developments in the public and policy discourse (Welsh and Wynne 2013; Saille 2014; Felt et al. 2016; Marris 2014). Participation is associated with more RRI (European Commission 2009; Organization for Economic Cooperation and Development 2015), thus creating an imaginary of participation encompassing better and more democratic innovation processes.

By adopting a symmetrical STS approach, we assume that imaginaries and innovation are coproduced and culturally embedded (Pfotenhauer and Jasanoff 2017a). We hence suggest that participation in innovation processes is “part of a collectively held imaginary of sociotechnical progress” (Pfotenhauer and Jasanoff 2017a, 786).

Various authors have devoted their attention to the value of imaginaries in participation (Welsh and Wynne 2013; Saille 2014; Felt et al. 2016). Welsh and Wynne (2013) describe how scientific imaginaries of the public and public imaginaries of science lead to different institutional settings of participation and influence how it is framed within science. Two such imaginaries recently came into being: one of an “uninvited” public who expresses social and political concerns reaching beyond institutionally defined risks and another one that understands the public as a threat to the innovative capability of science and technology (Hess 2014; Marris 2014). In keeping with these developments, de Saille (2014) suggests the term “unruly public” as part of the sociotechnical imaginary of critical, hindering voices that nonetheless does not exclude the public “as a whole” (Saille 2014, 99).

Still, the concept of imaginaries of participation must be further specified to see how the process of coproduction is enabled at the group level.

Referring to Jasanoff and Kim (2015), we examine how practices of collective imagination can produce consensus and might be capable of absorbing internal tensions within collectives (Jasanoff and Kim 2015, 27). In contrast to the notion of a national imaginary, we conceptualize group imaginaries as being akin to Moore's (2018) concept of a sociotechnical vision (p. 21), that is, they are a specific plan for a group to promote a certain sociotechnical idea. We assume group members' different sociotechnical visions are bound together through a group imaginary. We employ this specific understanding of the imaginary concept in order to show how a heterogeneous group can, despite very different interests, find common grounds for collaboration.

Heterogeneous Innovation Settings and Small Groups

This conceptualization of imaginaries allows us to scale down the concept from the macrolevel (Jasanoff 2004; Jasanoff and Kim 2015) to the group level and connect it to group research theory. Groups are defined as a collection of individuals who frequently interact with each other, share a feeling of belonging, and collaborate in order to achieve common goals (Hackman 2012). While sociological research has studied small groups since the 1950s (Bales 1950), this research stream is currently being transformed (Fine 2014).

From the early era of research on the topic, the study of small groups was considered to be especially fruitful because they are a "special case for a more general type of system, the social system" (Mills 1967, 2). Small groups are currently attracting more attention, as they are regarded as key sites that represent collective action, especially in the context of social change (Collins 1998; Summers-Effler 2010; Farrell 2001; Rochon 1998; Corte 2013; Burke and Stets 2009). Through them, scholars are able to identify macroscale dynamics on the microlevel (Stolte et al. 2001). A strand of sociological and psychological research suggests that small groups can conduct highly innovative research (Hackett and Parker 2016a; Mullins and Mullins 1973; Bennett, Gadlin, and Levine-Finley 2010; Gläser, Laudel, and Lettkemann 2016). Their group creativity benefits from the presence of four components: the resources, context, energy (emotion), and the management of ambivalence or tensions (Hackett and Parker 2016b).

The role of imaginaries in such settings, however, has received little attention thus far. Referring to Mills (1967), who regarded groups as feedback systems, imaginaries can be defined as a crucial component of a

group's consciousness as an "awareness of itself" (Mills 1967, 19). We argue that imaginaries are important means of self-reflection. We regard group imaginaries as a self-concept in which groups envision themselves as a collective that will arrive at an agreed-upon plan that will guide the group's behavior and goals. This approach represents a paradigm shift from analyzing linear cause-effect relationships toward describing the group's evolution over time by studying dynamic properties such as variability, trajectories, and cyclical fluctuation (Kozlowski 2015, 272). In this sense, groups are "complex, adaptive, and dynamic systems" "embedded in a hierarchy of levels and characterized by multiple, bidirectional and non-linear causal relations" (McGrath, Arrow, and Berdahl 2000, 98).

Research on group development typically builds on the life cycle model, in which groups go through a sequence of "storming, forming, norming, and performing" (Tuckman 2001; Tuckman and Jensen 1977, 419). Project groups in research and development have been found to reach peak productivity after three years (Katz and Allen 1982). In our case, the imaginary was a powerful resource that brought order to group processes. Contrary to the predictions of the life cycle model, this allowed for a peak of productivity at the very beginning of group development and led to group split-up before entering the "performing" stage.

Energy Avant-garde: The Case

The German government's act phasing out of nuclear power by 2022 (Knopf et al. 2014), passed in response to the Fukushima meltdown of 2011, gave rise to a national "energy transition." Within this transition, national power companies are increasingly reorienting toward renewable energies. While this process is characterized by high levels of uncertainty, some such companies choose to collaborate with other organizations, both within and outside of the energy industry. One such collaboration was the subject of this study. When it was first introduced in the Anhalt-Bitterfeld-Wittenberg region in Germany in 2013, the vision of Energy Avant-garde was that the region should become the flagship for the energy transition by developing a self-contained and renewable energy system (see Figure 1; <http://www.energieavantgarde.de> [last accessed March 1, 2017]).

This revolutionary, bottom-up, large-scale innovation initiative constitutes a unique case for two reasons. First, it is quite likely to provide new insights into participatory innovation due to its "reversal" of the dominant strategy: from the outset, its members have included a wide variety of stakeholders (see Table 1) who have engaged in loosely coordinated

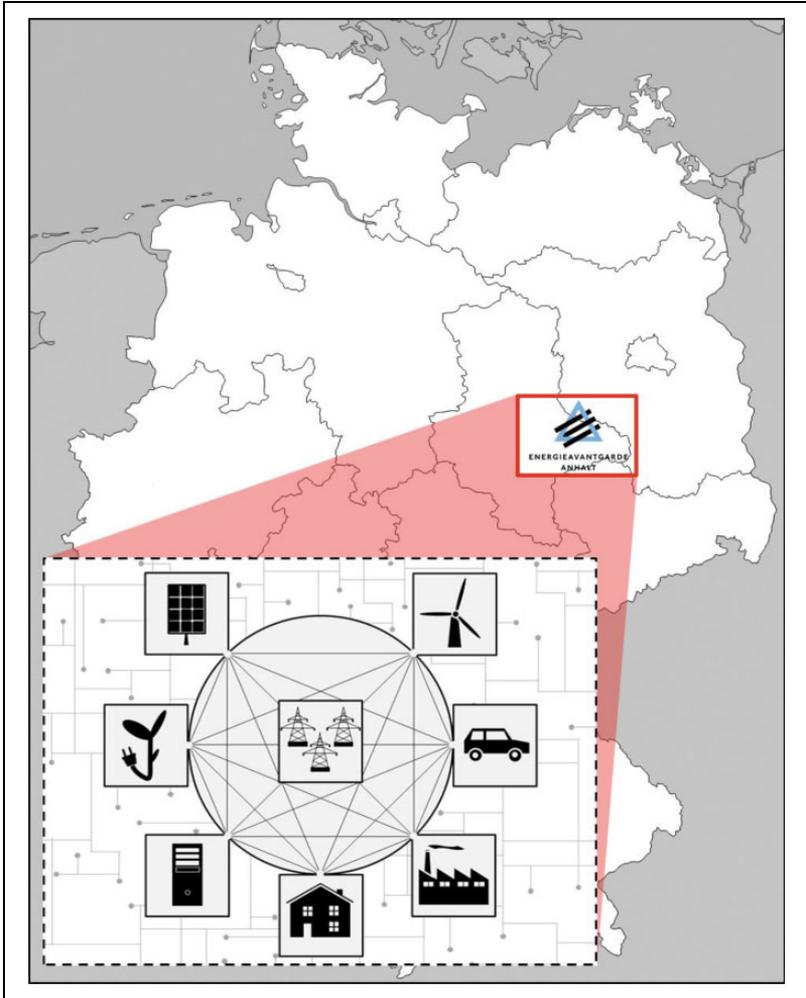


Figure 1. Area and vision of the initiative.

activities in pursuit of grand, vaguely defined goals. In contrast, participatory projects typically begin with focused targets, follow comparatively detailed plans of their achievement, and open only toward the conclusion (Bonaccorsi 2016). Second, the initiative pursues decentralization of a historically centralized energy system (Canzler et al. 2017a) within one region,

Table 1. Members of Energy Avant-Garde.

Type	Number
Consulting firm	8
Power supply company	5
Financial institution	1
Foundation	4
Government office	2
Plant engineering corporations (energy)	7
Regional and civil initiative	4
Research institute	5
Individual expert	5
Software company	2
Think tank	3
University	2
Urban administration office	2

a development in keeping with the observation that the greater public involvement on the decentral level leads to greater public willingness to support the energy transition (Wille 2017).

The region is a part of Saxony-Anhalt, a federal state in the South-East of Germany, formerly a part of East Germany. Throughout the entire twentieth century, coal exports were the state's primary source of income. In 2007, it began exporting renewable energies and currently occupies a leading position in the energy transition by satisfying 53.9 percent of its own electricity needs and 16.5 percent of its overall energy needs through three energy types: 58 percent wind, 26 percent biomass, and 13 percent solar. The state also produces 77 percent of the country's bioethanol and 10 percent of its biogas (<http://www.investieren-in-sachsen-anhalt.de> [last accessed March 1, 2017]).

The transition, however, has been anything but smooth. In order to guarantee a stable supply, the use of coal remains necessary in the winter (Höhne 2017). The introduction of an entirely new power system necessitates the development of equally original funding strategies, supply chains, and consumption patterns.

Method

We examined Energy Avant-garde in progress, primarily through participant observation (Jorgensen 2015; Spradley 1980), between April 2014 and

October 2016. To this end, we observed four workshops, to which we were granted full access. Each workshop lasted from one to seven days, and the sessions often continued late into the evening. Together, they resulted in eighty hours of audio records and our field notes on informal conversations. Two-and-a-half years was a sufficiently long period to allow us to closely and thoroughly study our case as well as to observe its long-term development.

The number of members of Energy Avant-garde varied during the period of our observation. While it was a small initiative in 2014, it grew rapidly. By 2016, fifty organizations had joined the initiative, with every participating organization nominating one representative. Most of the group members had attended a higher education institution, the share of male representatives was about 75 percent, and the average age of members was about forty-five years. The group was highly diverse with regard to disciplines (engineering, social sciences, law, arts) and sectors (public sector and private sector). The citizens who would eventually use the regionally produced energy were represented by small citizens' initiatives. Membership was granted on the basis of self-selection, as the initiative openly invited new members (in the region) to join.

The workshops took place every six months, with participant numbers ranging from thirty to sixty and different group compositions. They were organized in different locations, mostly in the region of Anhalt, but also on the German coast (Gut Siggen). Usually, group members met in plenary sessions; for some sessions, the initiative was divided into smaller units.

We co-organized the first workshop in Gut Siggen since the initiative hardly had any resources. This helped to immediately build trust bonds with the initiative members, which enabled us to get full first-hand access to all discussions and critical information. We also organized the fourth workshop where we discussed the results of our research with the initiative members. We thus became embedded researchers in the setting. This setting was especially insight-provoking as it enabled us to validate our research results. The other two workshops were organized by the management of the initiative.

Transcripts of these recordings were qualitatively examined through frame analysis (Goffman 1974), which is “the process whereby communicators act—consciously or not—to construct a point of view that encourages the facts of a given situation to be viewed in a particular manner [. . .]. Frames act to define problems, diagnose causes, make moral judgments, and suggest remedies” and “are central organizing ideas within a narrative account of an issue or event” (Kuypers 2009, 182).

Our approach was a suitable one for investigating group dynamics (Kozlowski and Bell 2013). Our goals were to determine how different interests, approaches to problem-solving, and problem definition were framed and how shared values and patterns of interpretation were constructed (Bohnsack 2010, 2014). Data were collected at multiple levels of analysis that enabled the identification of different patterns of group stability, change, and breakup. In order to analyze dynamic group development, we placed particular focus on the discussions about leadership (Mansilla, Lamont, and Sato 2015; Parker and Hackett 2012; Stokols et al. 2008), decision-making styles (Chompalov, Genuth, and Shrum 2002), group dynamics, collaborative engagement (Felt et al. 2016), individual motivation, interdisciplinary interaction (Parker and Hackett 2012), and inter- and intragroup conflicts (Pruitt and Kim 2004).

We grouped our findings according to four interdependent dimensions. Mansilla, Lamont, and Sato (2015) defined the emotional, cognitive, and interactional dimensions as relevant for group processes. Relying on Felt et al., we added a fourth perspective: the structural level. Special attention was paid to narratives (Hawes 1991) and metaphors (Schein 2010) to identify both individual and collective interpretative frames. We also included other relevant information such as details from the initiative's website, grant proposals, and protocols of the meetings.

Results: Innovation in Phases and the Imaginary of Participation

We closely observed development and dynamic changes focusing on the coevolution of the group and the imaginary. In a case as complex as energy transition, determining success and its criteria may pose a particular challenge. In the following chapters, we define success in terms of how the group itself defined goals and whether they were achieved or not.

Creation of the Imaginary: "The Spirit of Gut Sigger" (April 2014-January 2015)

The creation of the group imaginary of participation took place in the first phase and was strongly facilitated by configuring events at the interactional level. Energy Avant-garde was first introduced in April 2014 by four different organizations loosely collaborating on smaller projects (structural level). Momentum was generated when we organized the first workshop in April 2014, in which thirty regional and national actors spent a week

developing an outline of a grant proposal in the picturesque farmhouse of *Gut Siggen* at the Baltic Sea.

The workshop location provided a particular setting, referred to by Parker and Hackett (2012) as “island time,” which “strengthens group bonds, motivates productivity, catalyzes creativity, and builds emotional commitment to the group’s ideas, fostering a culture of receptivity and originality, while quieting skepticism and criticism” (Parker and Hackett 2012, 28). Island time had strong effects at the emotional level: this might explain why the group was highly cohesive at this point and characterized by an open and motivating work atmosphere despite wide-ranging differences in interest.

These positive group dynamics promoted the development of a shared imaginary of open participation, which reflected that of transformative innovation: the project was regarded as a pilot case for an “energy region” in which solutions for climate change are implemented in vivo and also as an opportunity for future pan-European and international collaboration. This imaginary grew very powerful because participants believed they were ultimately changing the region and the world for the better.

The core innovative element of this grassroots initiative was the vision of a renewable, decentral, and self-contained energy supply system that would achieve not only economic but social and environmental benefits. Such a system would entail a variety of new responsibilities and strategies on the regional level including energy marketplaces, prosumer involvement, and smart grids. The choice of the name “Avant-garde” indicates that, rather than a solely technological innovation, participants regarded the transition as a profound societal transformation that welcomed individuals from all backgrounds to participate:

Group member 18 (cultural sector): We cannot simply optimize load curves and energy inputs and then think we could create a regional energy system based on renewables. We would need to include a broader variety of actors, and that would change the social economy and culture in our region. That’s how we would enter a path to completely new futures, and that’s what we are interested in.

At the cognitive level, such a complex transformation requires integrative approaches capable of uniting varied interests across different sectors and over the long term. It will mean profound institutional changes as well as the reenvisioning of individual and shared roles.

Open participation was the core component of the developed group imaginary because members believed that opening the initiative to all interested stakeholders would promote both the project's success and democratic processes in the region generally:

Group member 15 (energy sector): The most important question is: how can I reach these groups of the population, which typically do not want to participate? How can I empower them? How can I guide them towards these solutions? These are not trivial questions. But only by means of research will we succeed here, not only through theory, but practice. And this is exactly why we need these regional labs, these real-world laboratories where we can create these kinds of experience.

This idea of a real-world laboratory constituted a vital element of the imaginary of open participation and served as a boundary object (Gieryn 1983) by organizing shared but simultaneously distributed cognition among various social worlds. This idea was sufficiently abstract to leave room for individual interpretation and sufficiently broad to provide common ground. It provided a protected space (Engels and Münch 2015), allowing for experimentation under no pressure to succeed. New, free, and independent from existing structures and institutional paths, it was expected to promote new innovative capabilities and socially robust knowledge (Nowotny, Scott, and Gibbons 2001).

Unanimous in their vision, participants' opinions about more specific, attainable goals and implementation strategies were at least as diverse as their own backgrounds. Inspired by these opinions, the discussion focused on such questions as: to what degree can locally produced, renewable energies satisfy the energy needs of a region? What might the limits of the decentralized supply be, not only from technical and economic standpoints but also societally and culturally? To what degree might consumers be willing to contribute to the establishment of the new system?

Accordingly, participants' interests were highly diverse as well: some were concerned with funding or business models and others were interested in new technical solutions or major cultural transformations. In this regard, not only did the imaginary of open participation exert a strong influence on participants' perceptions, it created common ground for collaboration and intellectual openness. Similarly to symbols that enable organized group action, the imaginary created meanings that were shared by all members and thus promoted communication: it appealed to the emotional dimension, unleashing "collective excitement" and "joy in collaboration" (Mansilla,

Lamont, and Sato 2015, 18) and created an atmosphere of letting go of traditional mind-sets. The following sequence of a group discussion reflects this process.

Group member 7 (politics): Just listening to the very first conversations of the meeting makes you realize that this constellation is truly something special. It is really fascinating to see that different disciplines have joined the project in order to show what this is all about: A grand societal project, maybe the biggest the Federal Republic of Germany has ever undertaken. As an industrial nation, we would like to see that we are able to supply resources based on 100-percent renewable energy in the long run . . .

Group member 15 (energy sector): I think everyone can easily see that all participants are working with great passion on questions that might have been answered from a theoretical perspective. But we have gathered here to demonstrate our will to add practice to this theory. This is a great way to test this social innovation, this technological innovation. Maybe our project does not make sense at all, because the consumer just cares about money and not about climate protection, but maybe not. This is the only way to find out about it . . .

Group member 3 (civil society): We have very heterogeneous actors collaborating; transdisciplinary work at its best. I was really excited that it worked out to bring together these diverse perspectives, so we did not end up with a cacophony, but a unified perspective, a truly homogeneous interest in the subject of decentralized energies.

Finally, it promoted not only a culture of trust, positive emotions, and creative collaboration but also the development of collective identity and commitment. This sequence demonstrates this open creative collaboration, where knowledge was openly shared in iterative ideation processes:

Member of the funding organization: So how does this transformation work, how do regional and national actors work together? How do we deal with the tensions between defined goals and process openness? This project will answer all these questions . . . The atmosphere at the last workshop was really intriguing for me. I know that this project will be successful when I look at the great composition of the participants. It has enormous potential . . .

Group member 9 (energy sector): . . . Real laboratory Energy Avant-garde. What does it mean in a nutshell? The biggest challenge will be to ask ourselves whether we are still innovative and bound to reality at the same

time. At the point when innovation loses connection to reality, the result will be only autism—nothing more. This means we need to look ahead, we need to look from the inside to the outside and from the outside to the inside. By bringing all these perspectives together, the Energy Avant-garde will be a great success.

Group member 17 (arts): A nice thought. Energy Avant-garde as a safe place for the interplay of different perspectives and disciplines.

Group member 9 (energy sector): Yes. Exactly.

Group member 24 (science): . . . Participation is very important from my point of view. Activating these actors is crucial . . . I imagine active, economically and technologically responsible citizens who will achieve this regional decentral energy transition together with the involved stakeholders. They will be the ones who actively create and sustain the change . . . This is a wonderful thing. The Energy Avant-garde can act as a broker to fill the gap between technological development and societal acceptance.

Group member 14 (tourism): Yes, this is a nice vision: The economically and technologically responsible citizen who will advance the energy transition. Let us work on it!

Group member 4 (politics): I think pioneering spirit is what Energy Avant-garde is all about. An atmosphere of departure. It is really great to see what we were able to achieve just within a few days. A huge undertaking. And from now on it will be even more exciting as we are able to implement what we have planned with the departure . . .

Pioneering spirit, free will, a sense of shared ownership, and the recognition of the initiative's unique value were the driving forces at this point, sparking enthusiasm and motivation.

The imaginary created a feeling of being part of a novel, exciting project with a regional and potentially global impact. It created its own narrative, referred to as the "spirit of Gut Siggen" and symbolizing this stage's ordering forces. This narrative was often mentioned in subsequent workshops.

Funding Organization Member: I would like to refer to the frequently mentioned "spirit of Gut Siggen." (. . .) I met such an interesting and enthusiastic group of actors who managed to immediately "infect" me with their passion. These people were interested not only in discussing the energy transition, but in implementing it as a grand societal transformation project.

I've never seen a project with similar vitality in this field. That's why I am very glad I came to this workshop.

By focusing on a clear, shared vision, the group imaginary reduced complexity and ambiguity. While it was sufficiently specific to convince actors and stakeholders to invest, it was also sufficiently general to allow for different aims and interpretations. By providing a homogenizing frame of orientation, it produced ordering forces in which wide-ranging interests could be united over a shared vision of the "sustainable energy region as a pilot case for the global transition," which would have been rather unlikely in the absence of such an imaginary. In this phase, the imaginary of participation supported goal achievement. The group was able to develop an original idea. Moreover, it attracted a major investor, which felt welcomed as a codesigner of an exciting project rather than just a donor—a foundation of a large European power company provided a three-year grant of 1.5 million euros. Because the goal of the first phase was to acquire funding, the initiative could be thus considered to have successfully crossed its first critical juncture.

Sustaining the Imaginary: Tensions Increase (January 2015-October 2015)

Group member 3 (civil society): It's most important to engage stakeholders and laypersons and to create eureka moments (...) to promote the idea of "Avant-garde." That won't work through a website (...). Meeting people, talking to people (...) should not be single actions, but ongoing effort.

The group was exposed to a formalization process due to the success of the imaginary of open participation. At the structural level, the need to produce outcomes increased. Institutionalization took place in January 2015 with the founding of a nonprofit association. That same year, an administrative office was opened and a governance structure established, consisting of a managing director, managing board, advisory committee, and management team. External funding facilitated the group development process, but at the same time, it strengthened the top-down forces in the group.

The second workshop took place in July 2015 in a town called Lubast. Its goal was to develop a more detailed strategy.

Group member 7 (politics): “I hope that the “spirit of Gut Siggen” will guide us via the “spirit of Lubast” to the winning side. (. . .) This workshop marks the turning point from the informal to a more formal stage of the project.

However, conflicts of interest arouse during the workshop, indicating difficulty in setting clear priorities (interactional level):

Group member 11 (science): On the one hand, our work is about great ideals, about partaking, about equity, and about answering the question of how we can make the world a better place, of how we can use creativity. On the other hand, we are dealing with pragmatic questions such as that of how we can we develop an effective business model, of how we can guarantee stability in the cities while continuing to use existing infrastructures? And the most important thing now is that both (perspectives) are valid.

Group discussions increasingly included different unrelated strands, which ultimately inhibited the development of clear, consensual goals, and strategies. Opposing mind-sets and perspectives came to power and members increasingly constructed the vision of the initiative in dichotomies. Other areas of tension also emerged:

Group member 30 (energy sector): We are talking about an area of conflict between a regional initiative, operating according to a regional and a national logic (. . .). It is our goal to optimize the regional value-added chain and to maximize the regional added value. On the other hand, it operates on a supraregional logic, which represents the interests of the foundations in producing knowledge that can be used for the further advancement of the energy transition, not only in Germany, but also throughout Europe.

Other participants argued that maintaining a regional focus was more important. The following quotation indicates the difficulty in reaching consensus on such basic issues as primary goals and desirable outcomes.

Member of the funding organization: We started our discussion by spending half an hour looking for solutions for the region, for the nationwide energy system, and for the transition in general (. . .). I argued that we would not be able to find those solutions. In my opinion, it is not our job to find a solution that can be adopted by the whole country.

Conflicts arose with regard to the necessary governance style: while some continued to insist on participatory approaches, others increasingly

expressed a preference for clearer, more hierarchical structures. In the pioneering stage, participative decision-making and informal, collegial communication were unanimous choices: the initiative was regarded as bottom-up, no formal leaders were nominated, and decisions were to be based on group consensus. Major conflicts were avoided by postponing the development of operational goals, detailed schedules, and formal division of labor:

Group member 13 (civil society): We do not have a preconception of any particular direction. This process is completely open with regard to its outcomes and results.

At that point, the focus was still on the autonomy of the initiative and the opportunity to let it unfold in which the learning process had the priority over the definition of tangible outcomes. At the cognitive level, we observed that group discussions were framed by an informal leader whose sources of power were his meta-knowledge about the energy transition, including economic, technical, political, and legal knowledge, as well as his charisma and rhetorical skills. He not only pointed out the problems but offered solutions and built upon the imaginary of open participation to express appreciation for the group and their aspiration to a global solution. By adopting different roles, such as that of a coach, expert, moderator, communicator, thought leader, and boundary spanner, he was able to reconcile different interests.

The initial imaginary of open participation included a democratic governance style. After the funding organization joined the initiative and the formal governance was established, the necessity for project management increased. The funding agent and some other participants expressed the necessity for a more hierarchical decision-making. The conflicts increased as they continued to insist on setting clear goals, while other participants continued to prioritize autonomy and openness.

Due to its high level of abstraction, the imaginary could no longer bring order to the group. Because the imaginary of participation did not support the group in attaining its goals, an alternative imaginary of expert participation began to develop and led to further disagreements in the group. The management director, originally elected because of his high standing in the region, continued to exercise a democratic, socioemotional leadership style and advocate for the initial imaginary. Rather than to influence the group or provide detailed explanations, he tried to balance tensions by keeping the relationships friendly and leaving it to the group to find consensus. These choices ultimately impeded decision-

making, (Burke 1967; Blake and Mouton 1964) while a task leader would have been necessary to advance the project at this stage.

The division of labor caused by the funding somewhat reduced the initial enthusiasm and motivation (emotional level). As the power structure changed, so did participants' roles to include different levels of involvement and responsibility. The attitudes of "mine and yours" increasingly replaced the sense of trust, collegiality, and shared ownership. The funding decreased some of the initial intrinsic motivation. Furthermore, no funds were allocated for certain necessary tasks such as the development of technological solutions, which led the feeling of injustice thus reducing the sense of shared ownership and identification with the project among some participants.

In keeping with the imaginary of open participation, new members were constantly invited to join the initiative or give feedback, resulting in high group fluidity and thus its decreased productivity: while involving new actors at the cost of impeding routinization might be beneficial in the innovation process, a certain amount of stability within the group is necessary for integrating new knowledge and developing a shared identity and language (Shinn 2005).

Upon the introduction of an institutional structure (Weber and Winckelmann 2009 [1921]), the heterogeneity within the group and the lack of functional leadership and group identity inhibited the process. The initial imaginary lost some of its power in which the same mechanisms that used to promote motivation, group cohesion, and the sense of identification now inhibited these effects. The imaginary worked as an abstraction and guided the process but lost force when process as an end in itself gave way to the need to produce outcomes. We found that success at the abstract level of commitment to participation set the stage for a crisis and put the group at risk, similar to the findings of Parker and Hackett (2012). Our results underline the importance of clearly differentiating between "process imaginaries," which are able to guide group processes and foster constructive group dynamics, and "outcome imaginaries," which are apt to produce concrete group outcomes.

While institutionalization was achieved, the implementation of particular subprojects and the involvement of other local organizations were not. Therefore, the next critical juncture was not crossed and the phase resulted in a crisis.

Conflicting Imaginaries: Crisis (November 2015-March 2016)

In this phase, the group oscillated between the two competing imaginaries. Tensions between the two positions resulted in increasing negative emotions and decreasing involvement within the group (emotional level). The

imaginaries of open and expert participation continued to conflict with one another with regard to organization, leadership, and project management, thus hindering achievement of the goals as well as group creativity and productivity.

The managing director advocated for “keeping it open,” while simultaneously refusing to assume a more formal leadership role (structural and interactional level). The crisis reached a crescendo when internal members and the funding organization began to communicate their discontent with the actual outcomes of the lab. As the following sequence of a group discussion shows, the group divided into two conflicting parties. One subgroup defended the process imaginary; the other group promoted a new outcome imaginary.

Member of the funding organization: Ever since I got involved in this project I wanted to start with the pilot projects. It was obvious. We would have been able to show fast impact, something measurable. But instead we discussed the same topics over and over again.

Group member 5 (energy sector): We were not able to achieve the goal from the point of view of the participating enterprises. For an entrepreneur, all that counts is the product. In this sense, the Energy Avant-garde was helpful because we were able to understand how complex our avantgardistic process is (. . .) But unless we can tell others: “Invest in this technology and you will benefit in the future!” we cannot consider ourselves successful at all. We have to show what products we have (. . .). Maybe the expectations were too high and too detailed. In the end this did not work.

Group member 3 (civil society): We have achieved something very important: a robust process and a concept of what a regional energy system should be. This is needed before you can actually develop a regional energy system. Yes, it took some time, but this time was needed. We have developed a robust conceptual blueprint. Sometimes you have to take a step back and see where you are standing. Then you re-define your goals. (. . .) There is a conflict between project and process. But realizing a project is a process.

Group member 18 (cultural sector): Our biggest deficit is participation. (. . .) Our conceptual work is all hollow words. (. . .) Our path will lead nowhere. If we have not achieved broad participation then we do not have a robust basis and common ground for discussion anymore.

Members were increasingly dissatisfied as they realized that the imaginary of open participation did not support the group in achieving their goals:

Group Member 18 (cultural sector): After two and a half years I'm rather sad when I'm asked: "What have you actually built? What have you installed?" Then I always say: Well, we've tried to make the actors work together.

A spreading sense of disillusion has replaced the initial excitement. Participants started to realize that their original idea of productive collaboration between widely ranging groups of experts and laypersons might have been too ambitious. They continued their attempts to advance such collaboration through different initiatives both within and outside the region.

Participants were disappointed about the degree of public involvement even though much effort was spent to that effect. This goal was not fully realized because of the difficulty to clearly communicate the lab's goals, desirable outcomes, and unique features.

Member of the funding organization: I find it interesting that we are somehow meandering around the key question of what the goal of the Energy Avant-garde should be. (...) And I believe that it is difficult (...) to formulate this goal outside of individual perspectives. But we need to be clear about this, otherwise they will have the impression that we don't know what we want. That would be a bad thing.

Frustration was building on many levels: expectations toward prospective financial revenues no longer appeared realistic, basic projects could not be implemented due to disagreements, and technological solutions could not be developed. Participants increasingly came to realize that the initial vision of transformative innovation may require substantially greater resources than was available:

Group member 2 (energy industry): We have to admit that it basically took 90 percent of our time to debate on basic stuff that we'd already discussed.

In the absence of a constructive leadership, conflicts remained unresolved and frustration deepened, impeding trust, respect, and appreciation as well as the climate of conviviality (Mansilla, Lamont, and Sato 2015) in general. While some actors kept trying to promote the initiative within the region, others increasingly shifted their focus toward the national level. Endless discussions about the missions indicated that the group lost their collective identity and sense of direction. These developments suggest

that the group failed to develop productive problem framing as well as group work styles and routines necessary to advance the initiative. At the cognitive level, the different bodies of knowledge and perspectives remained disintegrated, thus hindering co-learning and knowledge co-creation.

Group member 22 (energy sector): Well, it is not clear where the Energy Avant-garde is heading. What are the success factors that it needs? I have the impression that the term “Avant-garde” is not well chosen, because it asks too much of everyone. This concept is too big and it overburdens all participants. (...) Communication is extremely important. The inner circle needs more clarity on where our journey will go.

The initial imaginary of open participation thus lost its integrative power. The group was not able to generate the self-awareness necessary to deal with complexity. In Hackett and Parker’s (2016b) terms, the imaginary was not able to manage conflicts in order to maintain creativity. Still, we were also able to observe the coproductive moment of group development and imaginaries. Parts of the group did not support the initial imaginary as different interests arose. Leadership could have been the missing link between the different interests, allowing them to connect the process imaginary to the outcome imaginary. But this important leadership task of balancing tensions between regional and national actors, between social and economic goals, and between the two different imaginaries remained unfulfilled. Hence, a division was necessary to cross the next critical juncture.

Division Due to a Lack of a New Imaginary (April 2016-December 2016)

In response to the abovementioned disordering forces, the board first tried to save the Energy Avant-garde by producing concrete outcomes. In the third workshop in July 2016, the board urged participants to “defining clear goals” and “achieve visible results” (protocols 12 and 13), and everybody had to name a “game changer” for the energy transition.

In informal conversations, there were expressions of frustration about the current situation. There was a more open and free spirit of creativity in the beginning workshops, especially in “Gut Siggen,” one member told us. The atmosphere was characterized by an overly structured organizational approach that aimed to produce concrete outputs (protocol 13).

In an attempt to preserve the lab, it was reorganized by the board in the fall of 2016. Leadership that was characterized as too “easy going” was equated with “no leadership at all” (protocol 12). The authority of the managing director was questioned in several workshops, as the following sequence shows:

Managing director: Do we believe that our conceptual basis is strong enough so that every member of the Energy Avant-garde can buy into it? So I ask every single one of you: Is this conceptual basis strong enough to guide us to the next step? (...)

Board member: Well, I don’t think that it is in any way constructive to talk about questions like that now.

The board finally proposed a structural change, in order to establish a more hierarchical management arrangement. A new governance structure was introduced, in which a project manager replaced the managing director, and more formal systems of accountability and leadership, which included more hierarchical decision-making procedures, were established. Eligibility for participation became more exclusive. The focus shifted toward smaller, more manageable projects. Hence, an initiative that started as a large group was divided into various fragmented projects that had more focused and manageable goals in accordance with participants’ different interests. One such goal was the hosting of a project idea competition between smaller- and medium-sized power suppliers.

While the new imaginary gained importance, it did not embrace all of the different interests and visions to the same degree that the initial imaginary once had. The group was not able to create a new powerful and integrating imaginary. The advocates of open participation continued to promote their visions in the region, while advocates of expert participation proceeded to the national level (epistemic and emotional level).

Board member: I think it is interesting that the conflict between the regional and national level has so far been quite subliminal in all processes of Energy Avant-garde. Especially because it is not only a challenge but a central conflict that has the potential to break up the initiative. It is closely connected to an open versus a more structured process. (...) Bringing about a regional energy supply system is totally different to national innovation fantasies.

The Energy Avant-garde finally recognized the urgent necessity for division (structural level). As a result, a split-up between the regional and

national initiative occurred, where parts of the resources and activities (like the funding organization) were shifted toward a new organization that was founded in order to implement the project at the national level. Defenders of the initial imaginary of participation remained in the regional initiative, whereas agents of the new governance style and imaginary of expert participation were mostly found in the implementation of the national level.

Conclusion and Further Research

While studies of transformative, heterogeneous innovation settings on the group level are scarce, the Energy Avant-garde provides a particularly interesting case. Because its setting was very open, complex, and loosely defined, the ways of achieving its goals were not immediately obvious. This setting was a particularly suitable one for studying groups as complex systems. Our findings suggest that such contexts can particularly benefit from imaginaries that promote common goals while allowing for flexibility.

We focused on the dynamic interaction between group development and the construction of imaginaries by looking at different outcomes (productivity, decision-making, motivation). We have argued that the imaginary is a resource for structuring group processes, and a group is a resource for creating, operationalizing, sustaining, and revising an imaginary. Imaginaries and groups are coproduced (Jasanoff 2004). Cohesive, creative, and productive groups have effective imaginaries and follow their paths consciously and subconsciously. The case's "story," as told in the previous sections, can be regarded as that of "failing through success," which often takes place within paradoxical group dynamic processes (Parker and Hackett 2012).

In this sense, group imaginaries unleash positive and negative effects. They bind together different interests and identities and promote a common vision, fueling creativity and positive emotions and thus supporting the achievement of the greater project's goals. Just as paradigms act as (implicit) exemplars for conducting research (Kuhn 1996), imaginaries can substitute for tacit rules and instructions by setting desirable standards and defining permissible behaviors. They can provide exemplars for participation and strongly influence individual cognition, group dynamics, and governance styles as well as project development and outcomes. Imaginaries can also be used as subtle but strong means of leadership because they influence the cognitive, emotional, interactional, and structural level.

In our case, the imaginary of open participation was the first to develop and at its strongest in early phases when it promoted motivation, creativity, identification, and positive emotions such as trust, respect, and recognition. Contrary to the well-established “life cycle” model proposed by Tuckman and Jensen (1977), group performance was higher at the outset and decreased with time. The imaginary was supported and shaped by the group and this facilitated group cohesion as well as common ground and a sense of direction (see Figure 2). In the later phases, lower levels of group cohesion, performance, and creativity were observed. Due to a crisis, the group never reached the “performing” stage.

We therefore argue that imaginaries are not sufficient to carry a group project to development and fruition and that the imaginary of open participation is a particular type of imaginary with limited scope: it works as an abstraction and as a guide to a process but loses force when a process as an end in itself becomes subordinate to the need to produce outcomes. We propose a differentiated understanding of imaginaries of participation and distinguish between process imaginaries and outcome imaginaries. Process and outcome imaginaries have different purposes and different amounts of power at different stages of a group’s work. Process imaginaries are important in early stages of group development, especially in innovation processes (forming and storming), when ideation, conceptualization, exploration, and iterative knowledge construction are crucial. Process imaginaries offer orientation and support goal attainment when a clear structure is not yet established. They can provide a clear collective goal and enable productive problem framing. In later stages of the process, outcome imaginaries are more relevant; this is when the focus is put on the implementation of ideas and the development of products and services. In our case, the imaginary of open participation served as an effective process imaginary but failed to serve as an outcome imaginary. In this sense, the group lacked ambivalence management and was unable to shift from an open and imagining mode to the more constrained and productive mode centering on what is possible with available resources at present. Leadership that could have supported this shift was not in place. This process negatively affected the most important components of group creativity: resources, context, and energy.

Leaders have to manage different group imaginaries carefully. In doing so, they should always consider the dynamics: while a purely socioemotional leadership style might be more beneficial at the outset, a more task-oriented style with some socioemotional elements might be necessary later. In our case, the task-oriented style replaced socioemotional leadership

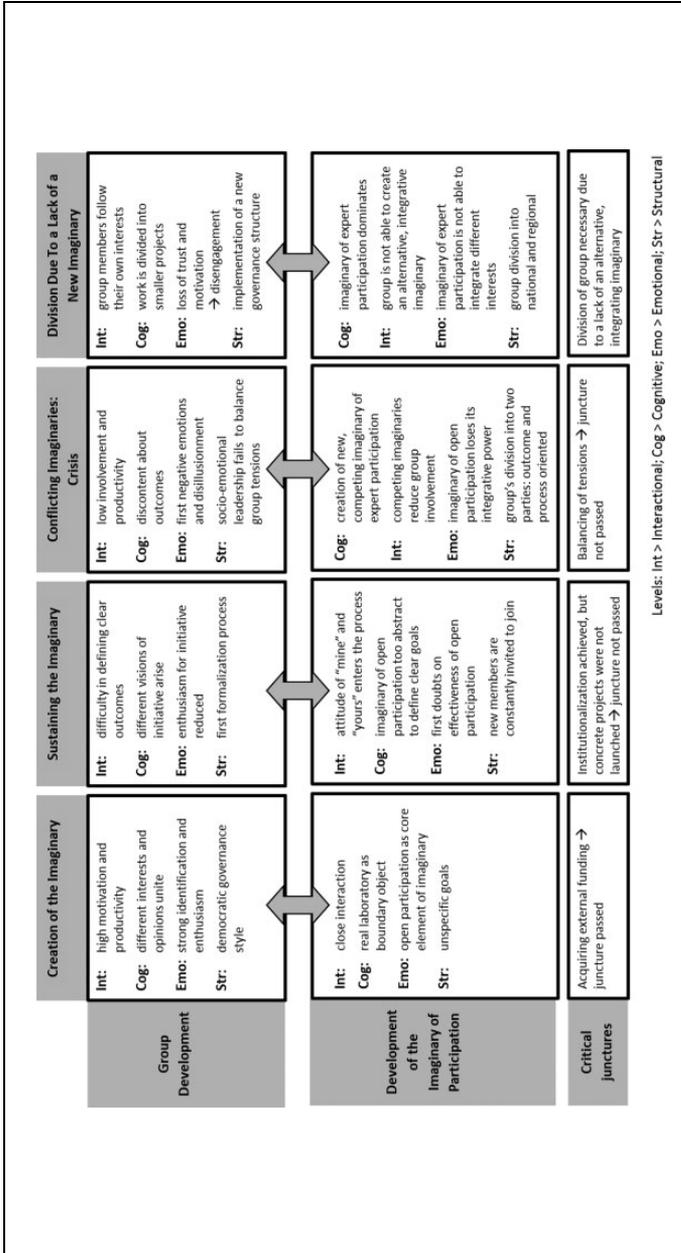


Figure 2. Development of imaginary of participation and group development.

rather than complementing it, which then led to further problems. Imaginaries of participation can be powerful for bringing different groups together and fostering innovation, but these settings must be managed and supported by suitable leadership strategies.

Acknowledgments

We especially thank the reviewers and the editor for their helpful comments on this paper. We would also like to thank Dagmar Simon, Andreas Knie, and Franziska Engels for discussing earlier versions of this manuscript. We further appreciate Anna Elnikova's, Tim Weihrauch's, and Karina Rosa Frank's assistance in background research for this paper.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was conducted at the "Science Policy Studies" research group at the WZB Berlin Social Science Center as part of the project "New Spaces for Collaboration between Science and Practice in the Social and Spatial Sciences," which was funded by the Federal Ministry of Education and Research in Germany (Support Code 03FO16005E).

References

- Bales, Robert F. 1950. "A Set of Categories for the Analysis of Small Group Interaction." *American Sociological Review* 15 (2): 257-63. doi: 10.2307/2086790.
- Bennett, L. M., Howard Gadlin, and Samantha Levine-Finley. 2010. "Collaboration and Team Science: A Field Guide." NIH Publication No. 10-7660. Accessed February 22, 2017. https://ccrod.cancer.gov/confluence/download/attachments/47284665/teamscience_fieldguide.pdf.
- Blake, Robert R., and Jane S. Mouton. 1964. *The Managerial Grid: Key Orientations for Achieving Production through People*. Houston, TX: Gulf.
- Bohnsack, Ralf. 2010. "Documentary Method and Group Discussions." In *Qualitative Analysis and Documentary Method in International Educational Research*, edited by Ralf Bohnsack, Nicolle Pfaff, and Wivian Weller, 99-124. Opladen, Germany: B. Budrich.
- Bohnsack, Ralf. 2014. "Documentary Method." In *The SAGE Handbook of Qualitative Data Analysis*, edited by Uwe Flick, 217-33. London, UK: Sage.
- Bonaccorsi, Andrea. 2016. "New Forms of Complementarity in the Innovation Process: International Expert Workshop: Participatory Settings of Innovation:

- Challenges for the Co-production of Knowledge.” WZB Berlin Social Science Center, Berlin, Germany, December 2.
- British Academy. 2016. “Crossing Paths: Interdisciplinary Institutions, Careers, Education and Applications.” Accessed August 23, 2017. <https://www.britac.ac.uk/sites/default/files/Crossing%20Paths%20-%20Full%20Report.pdf>.
- Burke, Peter J. 1967. “The Development of Task and Social-emotional Role Differentiation.” *Sociometry* 30 (4): 379-92. doi: 10.2307/2786183.
- Burke, Peter J., and Jan E. Stets. 2009. *Identity Theory*. New York: Oxford University Press.
- Callon, Michel, Pierre Lascoumes, and Yannick Barthe. 2009. *Acting in an Uncertain World: An Essay on Technical Democracy. Inside Technology*. Cambridge, MA: MIT Press.
- Canzler, Weert, Franziska Engels, Jan-Christoph Rogge, Dagmar Simon, and Alexander Wentland. 2017a. “Energiewende durch neue (Elektro-)Mobilität? Intersektorale Annäherungen zwischen Verkehr und Energienetzen.” In *Die Energiewende aus wirtschaftssoziologischer Sicht*, edited by Sebastian Giacomelli, 119-47. Wiesbaden, Germany: Springer Fachmedien Wiesbaden.
- Canzler, Weert, Franziska Engels, Jan-Christoph Rogge, Dagmar Simon, and Alexander Wentland. 2017b. “From ‘Living Lab’ to Strategic Action Field: Bringing Together Energy, Mobility, and Information Technology in Germany.” *Energy Research & Social Science* 27 (2017): 25-35. doi: 10.1016/j.erss.2017.02.003.
- Chilvers, Jason. 2008. “Deliberating Competence.” *Science, Technology, & Human Values* 33 (2): 155-85. doi: 10.1177/0162243907307594.
- Chompalov, Ivan, Joel Genuth, and Wesley Shrum. 2002. “The Organization of Scientific Collaborations.” *Research Policy* 31 (5): 749-67. doi: 10.1016/S0048-7333(01)00145-7.
- Collins, Randall. 1998. *The Sociology of Philosophies: A Global Theory of Intellectual Change*. Cambridge, MA: Belknap Press of Harvard University Press.
- Corte, Ugo. 2013. “A Refinement of Collaborative Circles Theory.” *Social Psychology Quarterly* 76 (1): 25-51. doi: 10.1177/0190272512470147.
- de Saille, Stevienna. 2014. “Dis-inviting the Unruly Public.” *Science as Culture* 24 (1): 99-107. doi:10.1080/09505431.2014.986323.
- Donina, Davide, Marco Seeber, and Stefano Paleari. 2017. “Inconsistencies in the Governance of Interdisciplinarity: The Case of the Italian Higher Education System.” *Science and Public Policy* 44 (6): 865-75. doi: 10.1093/scipol/scx019.
- Engels, Franziska, and Anna V. Münch. 2015. “The Micro Smart Grid as a Materialised Imaginary within the German Energy Transition.” *Energy Research & Social Science* 9 (September): 35-42. doi: 10.1016/j.erss.2015.08.024.

- European Commission. 2009. "Challenging Futures of Science in Society: Emerging Trends and Cutting-edge Issues." Accessed July 31, 2018. http://www.securepart.eu/download/com-2009_masis_report_expert-group_en150625092421.pdf.
- European Commission. 2013. *The Grand Challenge: The Design and Societal Impact of Horizon 2020*. EDC Collection. Luxembourg: Publications Office of the European Union.
- Farrell, Michael P. 2001. *Collaborative Circles: Friendship Dynamics and Creative Work*. Chicago: University of Chicago Press.
- Felt, Ulrike, Judith Igelsböck, Andrea Schikowitz, and Thomas Völker. 2016. "Transdisciplinary Sustainability Research in Practice: Between Imaginaries of Collective Experimentation and Entrenched Academic Value Orders." *Science, Technology, & Human Values* 41 (4): 732-61. doi: 10.1177/0162243915626989.
- Fine, Gary A. 2014. "The Hinge." *Social Psychology Quarterly* 77 (1): 5-26. doi: 10.1177/0190272514522769.
- Gibbons, Michael. 2011. *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. Reprinted. Los Angeles, CA: Sage.
- Gieryn, Thomas F. 1983. "Boundary-work and the Demarcation of Science from Non-science—Strains and Interests in Professional Ideologies of Scientists." *American Sociological Review* 48 (6): 781-95.
- Gläser, Jochen, Grit Laudel, and Eric Lettkemann. 2016. "Hidden in Plain Sight: The Impact of Generic Governance on the Emergence of Research Fields." In *The Local Configuration of New Research Fields: On Regional and National Diversity*, edited by Martina Merz and Philippe Sormani, 25-43. Cham, Switzerland: Springer International.
- Goffman, Erving. 1974. *Frame Analysis: An Essay on the Organization of Experience*. New York: Harper & Row.
- Hackett, Edward J., and John N. Parker. 2016a. "Ecology Reconfigured: Organizational Innovation, Group Dynamics and Scientific Change." In *The Local Configuration of New Research Fields*. Vol. 29, edited by Martina Merz and Philippe Sormani, 153-71. *Sociology of the Sciences Yearbook*. Cham, Switzerland: Springer International.
- Hackett, Edward J., and John N. Parker. 2016b. "From Salomon's House to Synthesis Centers." In *Innovation in Science and Organizational Renewal*. Vol. 45, edited by Thomas Heinze and Richard Münch, 53-87. New York: Palgrave Macmillan.
- Hackman, J. R. 2012. "From Causes to Conditions in Group Research." *Journal of Organizational Behavior* 33 (3): 428-44. doi: 10.1002/job.1774.
- Hawes, Leonard C. 1991. "Organizing Narratives/Codes/ Poetics." *Journal of Organizational Change Management* 4 (3): 45-51. doi: 10.1108/EUM000000001197.

- Hess, David J. 2014. "Publics as Threats? Integrating Science and Technology Studies and Social Movement Studies." *Science as Culture* 24 (1): 69-82. doi: 10.1080/09505431.2014.986319.
- Hippel, Eric von. 2006. *Democratizing Innovation*. Cambridge, MA: MIT Press.
- Höhne, Steffen. 2017. "Kein Öko-Strom im Winter: Braunkohle- und Gaskraftwerke müssen es richten." *Mitteldeutsche Zeitung*, February 10. Accessed March 01, 2017. <http://www.mz-web.de/25706736>.
- Jasanoff, Sheila. 2004. "Ordering Knowledge, Ordering Society." In *States of Knowledge: The Co-production of Science and Social Order*, edited by Sheila Jasanoff, 13-45. New York: Routledge.
- Jasanoff, Sheila, and Sang-Hyun Kim. 2013. "Sociotechnical Imaginaries and National Energy Policies." *Science as Culture* 22 (2): 189-96. doi: 10.1080/09505431.2013.786990.
- Jasanoff, Sheila, and Sang-Hyun Kim, eds. 2015. *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*. Chicago: University of Chicago Press.
- Jorgensen, Danny L. 2015. "Participant Observation." In *Emerging Trends in the Social and Behavioral Sciences*, edited by Robert A. Scott and Stephan M. Kosslyn, 1-15. Hoboken, NJ: John Wiley.
- Katz, Ralph, and Thomas J. Allen. 1982. "Investigating the Not Invented Here (NIH) Syndrome: A Look at the Performance, Tenure, and Communication Patterns of 50 R & D Project Groups." *R & D Management* 12 (1): 7-20. doi: 10.1111/j.1467-9310.1982.tb00478.x.
- Knopf, Brigitte, Michael Pahle, Hendrik Kondziella, Fabian Joas, Ottmar Edenhofer, and Thomas Bruckner. 2014. "Germany's Nuclear Phase-out: Sensitivities and Impacts on Electricity Prices and CO₂ Emissions." *Economics of Energy & Environmental Policy* 3 (1): 89-105. doi: 10.5547/2160-5890.3.1.bkno.
- Kozlowski, Steve W. J. 2015. "Advancing Research on Team Process Dynamics: Theoretical, Methodological, and Measurement Considerations." *Organizational Psychology Review* 5 (4): 270-99. doi: 10.1177/2041386614533586.
- Kozlowski, Steve W. J., and Bradford S. Bell. 2013. "Work Groups and Teams in Organizations." In *Handbook of Psychology: Industrial and Organizational Psychology*. 2nd ed., edited by Irving B. Weiner, Neal W. Schmitt, and Scott Highhouse, 333-75. Hoboken, NY: John Wiley.
- Kuhn, Thomas S. 1996. *The Structure of Scientific Revolutions*. 3rd ed. Chicago: University of Chicago Press.
- Kuypers, Jim A. 2009. "Framing Analysis." In *Rhetorical Criticism: Perspectives in Action*, edited by Jim A. Kuypers, 181-204. Lexington studies in political communication. Lanham, MD: Lexington Books.

- Leahey, Erin, Christine M. Beckman, and Taryn L. Stanko. 2016. "Prominent but Less Productive." *Administrative Science Quarterly* 62 (1): 105-39. doi: 10.1177/0001839216665364.
- Mansilla, Veronica B., Michèle Lamont, and Kyoko Sato. 2015. "Shared Cognitive-emotional-interactional Platforms: Markers and Conditions for Successful Interdisciplinary Collaborations." *Science, Technology, & Human Values* 41 (4): 1-42. doi: 10.1177/0162243915614103.
- Marris, Claire. 2014. "The Construction of Imaginaries of the Public as a Threat to Synthetic Biology." *Science as Culture* 24 (1): 83-98. doi: 10.1080/09505431.2014.986320.
- McGrath, Joseph E., Holly Arrow, and Jennifer L. Berdahl. 2000. "The Study of Groups: Past, Present, and Future." *Personality and Social Psychology Review* 4 (1): 95-105. doi: 10.1207/S15327957PSPR0401_8.
- Mills, Theodore M. 1967. *Sociology of Small Groups (Foundations of Modern Sociology)*. Engelwood Cliffs, NJ: Prentice Hall.
- Moore, Sharlissa. 2013. "Envisioning the Social and Political Dynamics of Energy Transitions: Sustainable Energy for the Mediterranean Region." *Science as Culture* 22 (2): 181-88. doi:10.1080/09505431.2013.786994.
- Moore, Sharlissa. 2018. *Sustainable Energy Transformations, Power, and Politics: Morocco and the Mediterranean*. 1st ed. Routledge studies in energy transitions. New York: Routledge.
- Moore, Sharlissa, and Edward J. Hackett. 2016. "The Construction of Technology and Place: Concentrating Solar Power Conflicts in the United States." *Energy Research & Social Science* 11 (January): 67-78. doi: 10.1016/j.erss.2015.08.003.
- Mullins, Nicholas C., and Carolyn J. Mullins. 1973. *Theories and Theory Groups in Contemporary American Sociology*. New York: Harper & Row.
- The National Academies. 2005. *Facilitating Interdisciplinary Research*. Washington, DC: The National Academies Press. Accessed July 9, 2019. <http://www.na.p.edu/books/0309094356/html>.
- Nowotny, Helga, Peter Scott, and Michael Gibbons. 2001. *Re-thinking Science: Knowledge and the Public in an Age of Uncertainty*. Cambridge, MA: Polity.
- Organization for Economic Cooperation and Development, ed. 2015. *Innovation Policies for Inclusive Growth*. Paris, France: OECD.
- Parker, John N., and Edward J. Hackett. 2012. "Hot Spots and Hot Moments in Scientific Collaborations and Social Movements." *American Sociological Review* 77 (1): 21-44. doi: 10.1177/0003122411433763.
- Pfotenhauer, Sebastian, and Sheila Jasanoff. 2017a. "Panacea or Diagnosis? Imaginaries of Innovation and the 'MIT Model' in Three Political Cultures." *Social Studies of Science* 47 (6): 783-810. doi: 10.1177/0306312717706110.

- Pfotenhauer, Sebastian, and Sheila Jasanoff. 2017b. "Traveling Imaginaries: The 'Practice Turn' in Innovation Policy and the Global Circulation of Innovation Models." In *The Routledge Handbook of the Political Economy of Science*, edited by David Tyfield, Rebecca Lave, Samuel Randalls, and Charles Thorpe, 416-28. Routledge international handbooks. London, UK: Routledge.
- Pruitt, Dean G., and Sung H. Kim. 2004. *Social Conflict: Escalation, Stalemate, and Settlement*. 3rd ed. McGraw-Hill series in social psychology. Boston, MA: McGraw-Hill.
- Rhoten, Diana, and Andrew Parker. 2004. "Education. Risks and Rewards of an Interdisciplinary Research Path." *Science (New York)* 306 (5704): 2046. doi: 10.1126/science.1103628.
- Rhoten, Diana, and Stephanie Pfirman. 2007. "Women in Interdisciplinary Science: Exploring Preferences and Consequences." *Research Policy* 36 (1): 56-75. doi: 10.1016/j.respol.2006.08.001.
- Rochon, Thomas R. 1998. *Culture Moves: Ideas, Activism, and Changing Values*. Princeton paperbacks. Princeton, NJ: Princeton University Press.
- Schein, Edgar H. 2010. *Organizational Culture and Leadership*, 4th ed. The Jossey-Bass business & management series. San Francisco, CA: Jossey-Bass.
- Shinn, Terry. 2005. "New Sources of Radical Innovation: Research-technologies, Transversality and Distributed Learning in a Post-industrial Order." *Social Science Information* 44 (4): 731-64. doi: 10.1177/0539018405058218.
- Spradley, James P. 1980. *Participant Observation*. Fort Worth, TX: Harcourt Brace Jovanovich.
- Stokols, Daniel, Kara L. Hall, Brandie K. Taylor, and Richard P. Moser. 2008. "The Science of Team Science: Overview of the Field and Introduction to the Supplement." *American Journal of Preventive Medicine* 35 (2): 77-89. doi: 10.1016/j.amepre.2008.05.002.
- Stolte, John F., Gary A. Fine, Karen S. Cook, and Gary Alan. 2001. "Sociological Miniaturism: Seeing the Big through the Small in Social Psychology." *Annual Review of Sociology* 27 (1): 387-413. doi: 10.1146/annurev.soc.27.1.387.
- Summers-Effler, Erika. 2010. *Laughing Saints and Righteous Heroes: Emotional Rhythms in Social Movement Groups*. Chicago: University of Chicago Press.
- Tidwell, Abraham S. D., and Jessica M. Smith. 2015. "Morals, Materials, and Technoscience: The Energy Security Imaginary in the United States." *Science, Technology, & Human Values* 40 (5): 687-711. doi: 10.1177/0162243915577632.
- Tuckman, Bruce W. 2001. "Developmental Sequence in Small Groups." *Group Facilitation: A Research and Applications Journal* 3 (2001): 66-81.
- Tuckman, Bruce W., and Mary A. C. Jensen. 1977. "Stages of Small-group Development Revisited." *Group & Organization Management* 2 (4): 419-27. doi: 10.1177/105960117700200404.

- Weber, Max, and Johannes Winckelmann. 2009 [1921]. *Wirtschaft und Gesellschaft: Grundriss der verstehenden Soziologie*. 5th ed. Tübingen, Germany: Mohr-Siebeck.
- Welsh, Ian, and Brian Wynne. 2013. "Science, Scientism and Imaginaries of Publics in the UK: Passive Objects, Incipient Threats." *Science as Culture* 22 (4): 540-66. doi: 10.1080/14636778.2013.764072.
- Wille, Joachim. 2017. "Der Kampf der Bürger gegen die Monstertrassen." *Frankfurter Rundschau*, February 20. Accessed January 03, 2017. <http://www.fr.de/wirtschaft/energie/energiewende-der-kampf-der-buerger-gegen-die-monstertrassen-a-959214>.

Author Biographies

Anna Froese is a senior researcher at the "Science Policy Studies" research group at the WZB Berlin Social Science Center. She leads a project group on interdisciplinarity and research creativity. Her work focuses on science and innovation research, knowledge transfer, and research collaborations. In her PhD thesis, she compared the organizational design of German and US American universities. Furthermore, she serves as an independent expert for the European Commission.

Natalie Mevissen is a senior researcher at the "Science Policy Studies" research group at the WZB Berlin Social Science Center. Her research interests are science and technology studies, especially science studies of the social sciences. In her PhD, she hence focused on sociology and its engagement with society, exploring sociologists' self-descriptions, and their understandings of the discipline. She is also interested in innovation studies and sustainability studies. She has worked in several research projects concerned with knowledge and technology transfer, innovation policy (public), participation in innovation processes, and new forms of sustainable mobility.