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Vegard Kolbjørnsrud
On governance in collaborative communities

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Deliberate design and action in collaborative

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On governance in collaborative communities

by

Vegard Kolbjørnsrud

A dissertation submitted to BI Norwegian Business School
for the degree of PhD

PhD specialisation: Strategic management

Series of Dissertations 12/2014

BI Norwegian Business School

Vegard Kolbjørnsrud
On governance in collaborative communities

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2014

Series of Dissertations 12/2014
ISBN: 978-82-8247-095-7
ISSN: 1502-2099

BI Norwegian Business School
N-0442 Oslo
Phone: +47 4641 0000
www.bi.no

Printing: Allkopi

The dissertation may be ordered from our website:
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Acknowledgements

Doing a PhD is a bit like “A Pilgrim’s Progress” (Bunyan, 1678-84); a long journey involving difficult challenges along the way, but also with positive surprises and the kind help of others, before eventually reaching the destination. There are a number of people that have contributed and helped me along the way. Without them this project would probably not have taken place, and certainly not in the form and with the outcome that this dissertation is the representation of. I am very grateful.

First, I would like to thank my advisors Øystein D. Fjeldstad and Robert J. Thomas. Øystein, you have guided, challenged, and supported me throughout the whole project; from its inception when we discussed different research ideas, through developing research questions and skills, developing paper ideas, and writing up and developing the final text. You have not tried to make it an easy trip, but a learning journey with an outcome that is the best I can achieve. You have many fine qualities as a scholar, colleague, and friend. Bob, you have generously welcomed me and made me feel as a part of Accenture Institute of High Performance, provided insightful feedback, and opened your academic and business network for me. The latter has been particularly important in identifying and getting access to research cases. I am looking forward to future collaboration with both of you. Thanks a lot to my predoc committee, Børge Obel and Helene Colman, for insightful, developmental feedback and a stimulating discussion.

Thank you also to Accenture for financial and operational support. I would particularly like to mention Kirsti Kierulf, Bente Svensson, and Petter Knudsen. Thank you for believing in me, supporting me, and for allowing me full academic freedom. Thanks also to my fellow Accenture Industrial PhD candidate colleagues, Ida Iren Eriksen and Anne Thorseng. The project has benefited from financial support from Research Council of Norway under the Industrial PhD scheme project no. 198058.

I have had the privilege of exploring four fascinating communities in the empirical part of my project. In the process I have interviewed and interacted with a large number of intelligent, knowledgeable, interesting, and friendly people across multiple countries on three continents. Your inputs are the basis for this dissertation and you have made this such an interesting journey. Some people have been particularly important and very helpful in the case work: Bob Suh, Zakir Thomas, Anshu Bhardwaj, Cissy Sleight, Joakim Jansson, Alf Lande, and Per Mortensen. Without your generous help in sharing your ideas and experiences, opening your networks, and introducing me to your collaborators and community members, I would never have been able to do this project. Thank you so much!

I have benefited from interesting, inspiring, and challenging interactions with a large number of individuals who all have contributed to develop my thinking, ideas, research practices, and papers. I would particularly like to mention: Erik Aadland, Binh Phan, Ieva Martinkenaite-Pujanauskiene, Bente Løwendahl, Andrew Pettigrew, Charles Snow, Alessandra Luzzi,

Thomas Hoholm, Arne Krumsvik, Sebastiano Lombardo, Lene Pettersen, Karl Inge Tangen, Raghav Narsalay, Chetan Chawla, Phanish Puranam, Anton Diachenko, Yuriy Zhovtobryukh, Xiaobei Wang, Carolin Hagen, Jody Hoffer Gittell, Ben Gomes-Casseres, Amir Sasson, Ragnhild Kvålshaugen, Mark Kriger, Daved Barry, Chandler Johnson, and Paulina Junni.

During the last four years I have been a part of Department of Strategy and Logistics at BI Norwegian Business School. I have thoroughly enjoyed working here and enjoyed the company of my colleagues. I would particularly like to thank the department leadership and administration for generous support: Randi Lunnan, Kai Rune Mathiesen, Birte Marie Horn-Hanssen, Tove Orheim, Silje Engeseth, Randi Maria Johansen, and Fred Wenstøp.

My greatest gratitude goes to my wonderful family. Barbro, you're the love of my life and in this challenging period for both of us you have proved why, again. Without your support I would never have embarked on this journey and would certainly not have completed it. Kristian, Henrik, and Ingrid, you are my inspiration. There is never a boring moment when you're around. Thank you also to my parents for always being supportive, loving, and demonstrating what's important in life. Finally, I am thanking God for the gift of life and blessings more than I can count.

Introduction

In an increasingly dynamic and networked knowledge society the nature and boundaries of organizations are extended (Castells, 1996; Gulati, Puranam, and Tushman, 2012; Powell, Koput, and Smith-Doerr, 1996). Increasing knowledge intensity, complexity, pace of change, technological advances, changes in resource availability, and globalization challenge existing organizational arrangements and in response new organizational forms emerge (Daft and Lewin, 1993; Fjeldstad *et al.*, 2012; Lakhani and von Hippel, 2003; von Hippel and von Krogh, 2003), as new conditions require new strategies and new organizational forms (Chandler, 1962; Child, 2005).

Collaborative forms are particularly prominent (Cross *et al.*, 2010; Hansen, 2009; Heckscher and Adler, 2006; Lavie and Drori, 2012). Such forms are increasing both in number and impact across diverse and important fields such as biotechnology, professional services, information and communication technology, financial services, health care, and military operations (Applegate, 2006; Benkler, 2002; Fjeldstad *et al.*, 2012; Maccoby, 2006; Powell *et al.*, 2005). Recently, collaborative communities have attracted scholarly attention in the emerging literature on collaborative organizational forms (Adler, 2001; Heckscher and Adler, 2006; Snow *et al.*, 2011). Such designs enable large groups of collaborating actors to self-organize, implying that they accomplish control and coordination primarily via direct interaction among themselves (Benkler, 2002; Fjeldstad *et al.*, 2012). With characteristics such as actor autonomy, self-assignment to tasks, sharing of resources in commons, and peer-based control the new collaborative community designs appear to be governed significantly differently than conventional hierarchical designs (Lee and Cole, 2003; O'Mahony, 2007; Ostrom and Hess, 2006; Puranam, Alexy, and Reitzig, 2014). The extant literature highlights some important governance challenges and mechanism in such forms, but our understanding of this topic is still quite limited (Sitkin, Cardinal, and Bijlsma-Frankema, 2010). This study explores how collaborative communities are governed.

This dissertation is structured as follows: First, in this chapter I review the literature on collaborative communities, identify common governance challenges and mechanisms, and motivate the research questions. In the appendix to this introductory chapter I define and briefly discuss some key concepts. In the second chapter, I describe the methods of this project in terms of research design, case selection, data collection, and analysis. Then I present the three research papers that constitute the core of this dissertation. Finally, in the conclusion chapter I summarize the findings, synthesize and discuss implications for research and practice, and conclude.

The rise of communities and collaborative organizational forms

Contemporary organizations are facing major environmental changes creating both challenges and opportunities. The rise of the knowledge society and advances in information and communication technologies are among the most influential contextual forces (Castells, 1996;

Child and McGrath, 2001; Zammuto *et al.*, 2007), and in the following I briefly discuss their impact on organizations.

Wide diffusion of higher education and academic knowledge across both the developed and the developing world has made knowledge-intensive research, development, production, and service provisioning possible to do nearly anywhere in the world and made it close to impossible for organizations and countries to monopolize on knowledge (Chesbrough, 2003; Schofer and Meyer, 2005). The emergence of knowledge workers challenges traditional managerial structures and practices as organizational members become more independent, empowered, and capable of making decisions about their work (Blackler, 1995; Drucker, 1993). Increasing knowledge and information intensity poses important organization design challenges that conventional hierarchical designs have problems accommodating (Child and McGrath, 2001); such as greater interdependence (Puranam, Raveendran, and Knudsen, 2012; Whitman, 1999), disembodiment of performance from asset ownership (Dibiaggio, 2007), higher pace of change (D'Aveni and Gunther, 1995; Eisenhardt, 1989), and shift toward knowledge-based power (Coff, 1999; Mudambi and Navarra, 2004).

Over the last decades advanced information and communication technologies (ICT) have made powerful tools for communication, information storage, access, and processing widely available and affordable (Castells, 1996). The Internet and other telecommunication technologies connect individuals and organizations in all parts of the world and enable real-time communication of text, voice, and multimedia. Digital information in vast volumes can be stored, searched, and accessed from an array of connected devices. Powerful computational resources and software tools support sophisticated design, modeling, representation, and data mining, which enable new forms of complex problem solving. These technological advances enable new and enhanced organizational capabilities (Zammuto *et al.*, 2007) such as visualizing entire work processes (e.g. Barki and Pinsonneault, 2005), real-time/flexible product and service creation (e.g. Majchrzak, Cooper, and Neece, 2004), virtual collaboration (e.g. Griffith, Sawyer, and Neale, 2003), mass collaboration (Boudreau and Lakhani, 2013), and simulation/synthetic representation (Augen, 2002; Carroll *et al.*, 2006).

The changing conditions have contributed to the emergence of new collaborative organizational forms. The new forms have attracted a large number of organization studies yielding a multitude of partly overlapping organizational concepts such as the network organization (Miles and Snow, 1986; Powell, 1990), the learning and knowledge-creating organization (Nonaka and Takeuchi, 1995; Senge, 1990), the I-form (Miles *et al.*, 2009), the virtual organization (Handy, 1995; Mowshowitz, 1994), the C-form (Seidel and Stewart, 2011), the collaborative community (Heckscher and Adler, 2006; Snow *et al.*, 2011), the meta-organization (Gulati *et al.*, 2012), and the actor-oriented architecture (Fjeldstad *et al.*, 2012). All of these studies examine organizational forms conducive to collaboration, problem solving, learning, innovation, resource sharing, adaptiveness, and continuous improvement. Community forms of organizing are among the most salient new forms (O'Mahony and

Lakhani, 2011) and their emergence is stimulated by the “demand for complex, knowledge-based and solutions-oriented production in the modern capitalist economy” (Heckscher and Adler, 2006: 12). In this dissertation I focus on collaborative communities (Heckscher and Adler, 2006).

Collaborative communities

The term community is in use in a wide variety of disciplines, such as sociology, psychology, biology, anthropology, and organization science (Adler, Kwon, and Heckscher, 2008; Barth, 1969; McMillan and Chavis, 1986; Suttles, 1972; Tönnies, 1887). In the sociological community literature a community has at least two basic characteristics (Etzioni, 2003). The first is a network of relationships on an individual and/or organization level. This network of relationships is typically more cohesive within a community than outside it. Second, commitment to a set of shared values, norms affecting the behavior and identity of members. A community has to be able to exert moral suasion and extract a measure of compliance from its members (Pearson, 1995: 47). At least four types of communities are discussed in sociology (Tropman, Erlich, and Rothman, 2001): 1) geographic communities such as neighborhoods, towns, or nations (e.g. Hunter, 1974; Whyte, 1943); 2) cultural communities such as ethnic and religious communities (e.g. Barth, 1969); 3) community organizations such as informal family or kinship networks and professional associations (e.g. Van Maanen and Barley, 1984); and 4) organizations with community characteristics (Adler, 2001; e.g. Lee and Cole, 2003; Wenger, 1998). Communities are potentially nested and overlapping. Collaborative community forms are a subset of the latter category.

A collaborative community is an organizational form that enables and enhances networking among autonomous and interdependent participants, entailing membership, commitment to shared purposes and rules for participation (Heckscher and Adler, 2006; Snow *et al.*, 2011). Communities nurture the capabilities of their members, and they provide shared services that allow members to collaborate with one another and collectively generate joint productive outputs beyond serving each member’s individual interests and needs (Snow *et al.*, 2011: 7). Such designs enable large groups of collaborating actors to self-organize, implying that they accomplish control and coordination primarily via direct interaction among themselves rather than by hierarchical subordination (Fjeldstad *et al.*, 2012).

The extant literature reveals important additional properties of collaborative community designs: Commons are essential in production, sharing, and accumulation of resources (Benkler, 2002; Lee and Cole, 2003). Infrastructures provide spaces for collaboration and sharing (Ostrom and Hess, 2006; Scacchi, 2002). Shared values create high levels of trust which is conducive to collaboration (Heckscher and Adler, 2006). Diversity of participant knowledge, skills, and views is favorable to complex problem solving and generation of novel opportunities (Bonaccorsi and Rossi, 2003; O'Mahony, 2007; Page, 2007). Participants are typically motivated by both contributing to a common good and achieving private benefits (Lakhani and Wolf, 2005; Lerner and Tirole, 2002; von Hippel and von Krogh, 2003). Finally,

the associated organizational design processes have strong emergent properties (Garud, Jain, and Tuertscher, 2008; O'Mahony and Ferraro, 2007).

Open source software (OSS) communities are probably the most common form of collaborative community and “commons-based peer production” (Benkler, 2002) and has become a major societal and economic force (von Krogh and Spaeth, 2007). The largest OSS developer platform hosts over 430,000 projects and 3.7 million developers.¹ The computer operating system Linux, the web server Apache, and the Firefox web browser are among the largest and most well-known OSS projects. OSS communities design and develop software collaboratively. The source code is freely available as a public good, and in addition to contributing cumulatively to the software, participants and any users are free to make their own versions adapted to their own needs (Raymond, 1999). Furthermore, contributors may gain intrinsic rewards such as enjoyment and learning and non-monetary extrinsic rewards such as peer recognition from their invested efforts (Lakhani and Wolf, 2005; Lerner and Tirole, 2002; von Hippel and von Krogh, 2003).

Governance challenges and mechanisms in communities have received recent attention in the emerging literature on OSS communities (de Laat, 2007; O'Mahony and Ferraro, 2007). OSS communities have characteristics that may not necessarily be shared with other forms of collaborative community; specifically, designing and developing a pure information good with a high degree of modularity and open and free access to a common resource (the source code) and the finished product (the software application)(Lerner and Tirole, 2002; Varian, 2000; von Hippel and von Krogh, 2003). This implies that other forms of collaborative community may have other governance challenges and mechanisms in addition to or instead of the ones known from OSS.

Community governance problems

Collaborative community forms display distinct governance challenges and mechanism (Baldwin and Clark, 2006; Benkler, 2002; Fjeldstad *et al.*, 2012; Garud *et al.*, 2008; O'Mahony, 2003; Ostrom, 2000), that I will discuss in this and the following section. Organizational governance refers to the means that organizations deploy to influence organization members and other stakeholders to contribute to organizational goals and purposes (Foss and Klein, 2013) and the means by which the goals and purposes are determined. Most of the literature on organizational governance is based on hierarchical schemes (e.g. Jensen and Meckling, 1976; Williamson, 1975), which is of limited relevance to communities. Drawing on a growing body of research on organizational and community governance, and in particular from the literatures on OSS and commons (e.g. O'Mahony, 2007; Ostrom, 2009), I will in the following discuss the governance problems of resource commons (Benkler, 2002; O'Mahony, 2003; Ostrom, 1990), team-based production (Alchian and

¹ <http://sourceforge.net/about>, April 16, 2014

Demsetz, 1972; Hamilton, Nickerson, and Owan, 2003), and complex problem solving (Nickerson and Zenger, 2004; Simon, 1962).

Commons

Commons is a key element of collaborative designs (Benkler, 2002; Fjeldstad et al., 2012) and pose unique governance challenges (O'Mahony, 2003; Ostrom, 1990, 2009). Commons, or common-pool resources (CPR), are shared resources that are built, managed, and used by a community and may consist of physical or of intangible resources, such as knowledge (Ostrom, 1990; Ostrom and Hess, 2006). Access to commons can be public (libertarian) or limited to a group or community (associational) (Levine, 2006). Ostrom (1990: 29) frames the commons problem as “how a group of principals who are in an interdependent situation can organize and govern themselves to obtain continuing joint benefits when all face temptations to free-ride, shirk, or otherwise act opportunistically.” Facing this collective-action problem they need to provide a set of rules, make credible commitments to comply with them, and establish and operate mutual monitoring (Ostrom, 1990: 42). Ostrom (1990, 2000) proposes design principles for how commons can be governed sustainably by the collective action of communities without suffering from “the tragedy of the commons” (Hardin, 1968): 1) clear boundary rules; 2) effective assignment of costs proportionate to benefits; 3) users of a resource design their own rules; 4) rules are enforced by local users or by actors accountable to them; 5) graduated sanctions; and 6) conflict-resolution mechanisms.

Initial focus was on governance of depletable natural resources. There is, however, increasing attention on knowledge commons, which is more directly applicable to most collaborative communities (Lee and Cole, 2003; Ostrom and Hess, 2006; Snow *et al.*, 2011). Knowledge commons comprise ideas—in terms of knowledge, information, and data—embedded in digital or analogue artifacts such as books, databases, and computer files (Hess and Ostrom, 2003). Examples include the local library, the genomic databases of The Human Genome Project (Collins, Morgan, and Patrinos, 2003), Wikipedia, the internet encyclopedia (Garud *et al.*, 2008), and the source code of open source software communities (Benkler, 2002; Lee and Cole, 2003). Knowledge commons are not depletable, but subject to social dilemmas such as free riding and private appropriation of the shared good (O'Mahony, 2003; Ostrom and Hess, 2006).

Team production

The problem of governing multiple actors who cooperatively produce joint outcomes—team production—is fundamental to all organizations including communities (Giuri *et al.*, 2010; Hamilton *et al.*, 2003; Holmstrom, 1982). Team production is characterized by multiple types of resources used in a production process, outcomes that are not a separable sum of outputs from each resource, and that all resources do not belong to one actor (Alchian and Demsetz, 1972). Team work may improve productivity due to complementary capabilities, mutual learning, peer pressure, and greater motivation, but can also cause free-riding problems as actors may shirk, under-invest or over-appropriate (Baldwin and Clark, 2006; Hamilton *et al.*,

2003; Holmstrom, 1982; Kandel and Lazear, 1992). Governance can be framed as a monitoring problem; to accurately assess the productivity of each resource and actor. Alchian and Demsetz (1972) prescribe hierarchy and a central contractual agent as the optimal solution to the team production problem. Yet, communities appear to accomplish control and coordination primarily via direct interaction among their members rather than by hierarchical subordination (Benkler, 2002; Fjeldstad *et al.*, 2012).

Complexity

Organizations across different domains have to deal with growing complexity due to increasing knowledge intensity, technological sophistication, interdependence, and dynamism (Anderson, 1999; Child and McGrath, 2001; Gulati *et al.*, 2012). Complexity is a function of the number of elements to a problem and the degree of interaction between them (Kauffman, 1993; Simon, 1962). Organizational complexity is often linked to problem solving (Nickerson and Zenger, 2004; Simon, 1962) and problem-solving organizations utilize the intensive technology to solve unstructured problems (Simon, 1973; Stabell and Fjeldstad, 1998; Thompson, 1967). The complexity of a problem to be solved influences the relative efficiency of alternative governance structures (Nickerson and Zenger, 2004). The elements of a complex problem are interdependent; hence a contributor within a particular knowledge domain cannot predictably enhance the value of a solution solely based on her own knowledge. Complex problems require extensive knowledge sharing and global search, thus amplifying knowledge formation hazards: 1) knowledge appropriation, i.e. the receiving party in knowledge sharing may appropriate the value at the expense of the sharing party; and 2) strategic knowledge accumulation, i.e. hoarding of knowledge and strategically altering the search paths and the heuristics guiding it (Nickerson and Zenger, 2004). The hierarchical response to complexity is the successive decomposition of complex problems into problems and tasks simple enough for human agents to accomplish and the coupling of the task structure with a managerial hierarchy where supervising actors govern the activities and resources of subordinate actors across multiple levels (Simon, 1962). The task decomposition structure and the corresponding management structure are stable and formal (Sabel, 2006). We know less about how communities manage complexity and govern complex problem solving. OSS communities utilize extensive modularization (Lerner and Tirole, 2002), which is a well-known approach to mitigate complexity (Baldwin and Clark, 2000), but in settings with higher levels of uncertainty, change, and interdependence modularization has limitations (Brusoni, 2005; Chesbrough and Kusunoki, 2001).

Community governance mechanisms

Organizations mitigate governance challenges by way of formal and informal governance mechanisms (Foss and Klein, 2013; Sitkin *et al.*, 2010). Research on community governance (e.g. see de Laat, 2007; O'Mahony, 2007; von Krogh and von Hippel, 2006 for reviews on governance on OSS communities) and in the adjacent fields of network governance (Jones, Hesterly, and Borgatti, 1997; Provan and Kenis, 2008) and commons governance (Ostrom,

1990, 2009) identify a number of such mechanisms. In the following review I discuss three of the main categories of community governance mechanisms found in literature: peer-based control (Lee and Cole, 2003), shared rules and norms (Ostrom, 2000), and trust (Adler *et al.*, 2008).

Peer-based control

Peer-based control mechanisms are a defining characteristic of collaborative community governance, contrary to the well-known authority-based mechanisms of hierarchies (Benkler, 2002; Fjeldstad *et al.*, 2012). Transparent task structure, resource commons, and membership let participants self-assign to tasks, contribute to and find new uses for shared resources, and initiate new collaborative relationships (O'Mahony, 2007; Puranam *et al.*, 2014). Mutual monitoring—when participants monitor each other—enables self-regulation and peer-based control and reduces information asymmetries (Child and Rodrigues, 2003; Ostrom, 1990; Varian, 1990). It simplifies the process of tracing contributions and efforts back to individuals (Holmstrom, 1982; Welbourne, Balkin, and Gomez-Mejia, 1995) and are commonly found in governance of commons of both natural resources and knowledge (O'Mahony, 2007; Ostrom, 1990). Peer review is an important form of mutual monitoring where participants review each other's work for the purpose of quality assurance. Peer reviewing is an institutionalized practice in e.g. academic research and publishing (Zuckerman & Merton, 1971) and open source software (OSS) (Lee & Cole, 2003). Following from such peer-based mechanisms, peer recognition becomes an important source of reward, motivation, and social status (Lakhani and von Hippel, 2003; Lerner and Tirole, 2002; Raymond, 1999; Stewart, 2005).

Shared rules and norms

The importance of shared rules and norms is a common theme in the literatures on communities and commons (Benkler, 2002; Heckscher and Adler, 2006; Ostrom, 1990; Ostrom and Hess, 2006; Van Maanen and Barley, 1984). Rules are guides to action (Knight, 1992:67). They can be constitutive and regulatory (Searle, 1969:33), enabling (Hart, 1994:57, 255) and constraining (Pettit, 1990:2). Rules in terms of protocols for interaction provide actors with the guiding principles to self-organize; effectively identify and mobilize collaborators and resources; collaboratively solve problems; share knowledge and ideas; and distribute rewards (Fjeldstad *et al.*, 2012). There is, however, less agreement on 1) what are effective rules and norms and 2) how they are formed and enforced.

On the first issue; rules have to be adapted to the context they are used, i.e. matching the biophysical and technological attributes of the resource and the resource system, the nature of tasks, users, their relationships, and the cultural and institutional context (Hess and Ostrom, 2003; Ostrom, 2009; Ostrom and Hess, 2006). As in many social and economic systems there is convergence on norms of reciprocity and fairness (Fehr and Gächter, 2000; Ostrom, 2000; Shah, 2006). Norms of reciprocity are for instance formalized in the GPL (GNU General Public License) and similar licensing schemes in OSS (O'Mahony, 2003; Stallman, 1999). Given the distributed, emergent, and protean nature of collaborative community designs, the

challenge becomes to establish rules that provide some stability and allow for entrepreneurial action. While the absence of rules possibly will lead to design fragmentation, too many rules can potentially stifle the design (Garud *et al.*, 2008: 365).

On the second issue of rule formation and enforcement, we see a diversity of patterns and schemes in the literature. Some communities are elitist, even bordering to autocratic, and some are highly participative and democratic (O'Mahony, 2007). The objective of achieving wide participation in community work, legitimacy of and compliance with its rules is common for all community designs (Fjeldstad *et al.*, 2012; Markus, 2007; Ostrom, 1990), and several studies suggest that user participation in crafting rules and in enforcing them is conducive to such (e.g. O'Mahony, 2007; Ostrom, 2000), but the evidence is not conclusive. In a study of Linux and Wikipedia, Garud and colleagues (2008) find the communities' product and organization designs to be incomplete and continuously evolving as they are elaborated over time. The communities provide an evolving set of governance mechanisms that are adapted as needs arise.

Trust

Trust is conducive to collaboration (Dodgson, 1993; Jarvenpaa and Leidner, 1999) and identified as an important governance mechanism in and a distinguishing mark of collaborative communities (Adler, 2001; Heckscher and Adler, 2006). Trust is “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party” (Mayer, Davis, and Schoorman, 1995: 712). It allows for effective knowledge creation and sharing and reduces the need for more intrusive governance mechanisms (Adler *et al.*, 2008; Hsu *et al.*, 2007). Trust in organizations is a multi-dimensional and multi-level construct that is viewed both as a governance mechanism in its own right (Bradach and Eccles, 1989), as a contextual factor influencing the efficacy of other governance mechanisms and itself being influenced by the use of other governance mechanisms (Hsu *et al.*, 2007; Kramer, 1999). Shared values and social embeddedness are important sources of trust in communities (Heckscher and Adler, 2006). Values are beliefs that “guide actions and judgments across specific objects and situations” (Rokeach, 1968:160). Shared values and common goals unite diverse participants and make their actions more predictable and less prone to opportunism. Embeddedness in cohesive social networks enhances trust (Coleman, 1988) in the form of process-based (or experience-based) and similarity-based trust (Bradach and Eccles, 1989; Zucker, 1986) as cohesive networks reflect past and present interactions and make actors more similar over time.

Research questions

In the literature review I have identified and elaborated some of the fundamental governance problems of collaborative communities related to building and sustaining resource commons, team production, and managing complexity. The commons and team production problems highlight the challenge of aligning the interests of diverse actors. All three of the main

problems points to the challenges of dealing with the complexities of problems, tasks, actors, relationships, and resources in communities.

The review of some of the main categories of governance mechanisms—in terms of peer-based control, shared rules and norms, and trust—reveals important structural properties and process challenges in the development of governance mechanisms, in particular the formation of shared rules.

In exploring the overarching research question of how collaborative communities are governed, I investigate three research questions which form the basis for each of the three research papers of this dissertation. In the following, I briefly introduce and motivate the research questions.

Governance of agency problems

As discussed above, collaborative communities comprise autonomous and often diverse members in potentially large numbers. Diversity of knowledge, skills, and views is useful in complex problem solving and in generating novel opportunities, but may also lead to diverging interests which give rise to governance challenges. Problems of diverging interests are commonly framed as agency problems in economics and organization theory, and commons and team production are examples of such. Hence, my first research question is:

RQ1: What are the agency problems in collaborative communities and what mechanisms are used to govern them?

Governance of complex problem solving

Business and societal problems are becoming increasingly complex and solving them requires dynamic mobilization, coordination, and governance of diverse sets of interdependent actors and resources across time and space. Collaborative communities are found particularly suited for such purposes, but outside the context of OSS and natural resource commons we have limited knowledge about how such designs govern and organize complex problem solving. In the second paper I explore:

RQ2: How is complex problem solving governed in collaborative communities?²

Deliberate design and design processes

The discussion of the formation and enforcement of rules shows that there are important process aspects to governance in communities. The process whereby rules emerge matters as well as the nature of the rules themselves. Studies show that organizational design processes in communities have strong emergent properties, but overall we know little about community design processes. From other organizational forms we know that the process of design is important both for the content of design and the ability to implement (Child, 2005; Nadler and Tushman, 1997). Design processes can be deliberate and emergent (Dunbar and Starbuck,

² As is discussed in the methods section, paper two is based on a single-case study in a drug discovery context; hence the research question in paper two is specified for that context.

2006; Garud, Kurnaraswamy, and Sambamurthy, 2006; Mintzberg and Waters, 1985). For any purposive organization one can expect its design to be influenced by conscious intention and reflection among organizational actors, i.e. some form of deliberate design (Child, 2005), but our knowledge of how deliberate action and emergent social processes shape community structure and vice versa (i.e. structuration process (Giddens, 1984)) is very limited. In the third paper I explore the following research question:

RQ3: What is the content and process of organization design and the role of deliberate design and action in collaborative communities?

Summary and concluding comments

In this dissertation I explore different facets of how collaborative communities are governed. The first two research questions focus on two major sources of governance issues—agency problems and complexity—and the mechanisms used to mitigate these. The first on agency problems targets macro-structural properties, while the second on complex problem solving directs attention to micro-level structures and processes. The third question focuses on the content and process of design and how community structure and participant action mutually shape each other over time, thus covering the interplay between structure and process across macro and micro levels. Taken together the research questions cover three major analytical dimensions in studying community governance: 1) governance issue—problems, mechanisms, and behavior/outcomes; 2) structure and process; and 3) level of analysis—macro and micro. The research questions form the basis for the three papers that constitute the core of this dissertation. The papers review relevant literature, motivate the research questions further, outline the methods, present the findings, and discuss implications.

Appendix to introduction: Some key concepts

A number of concepts central to this dissertation introduced in this chapter, are used throughout the papers. I define some of them here before proceeding. Therefore, the following terms are defined and briefly explained below: Collaboration, organizational governance, organization, organization design, and hierarchy. The notions of collaborative community and community were discussed in the section on “The rise of communities and collaborative organizational forms” above.

Collaboration

Collaboration is a central concept in recent literature on organizations and interorganizational relations (Ahuja, 2000; Hansen, 2009; Martin and Eisenhardt, 2010; Powell *et al.*, 1996; Powell *et al.*, 2005; Uzzi and Spiro, 2005). The colloquial meaning is to work jointly together, especially in an intellectual endeavor (Merriam-Webster, 2014).³ In this dissertation I follow Wood and Gray’s (1991: 146) conceptualization: “Collaboration occurs when a group of

³ Etymology of collaboration: Late Latin ‘collaboratus’, which is past participle of ‘collaborare’, i.e. to labor together. From Latin ‘com-’ + ‘laborare’, i.e. to labor. (Merriam-Webster, 2014)

autonomous stakeholders of a problem domain engage in an interactive process, using shared rules, norms, and structures, to act or decide on issues related to that domain.” Collaboration is a resource-demanding form of coordinated work involving extensive mutual adjustment, hence the costs (and alternative costs) of collaboration may outweigh the benefits (Hansen, 2009).

Collaborative settings are settings characterized by conditions conducive to collaboration and where collaboration frequently takes place. Such settings will typically also involve individual work and social exchanges not defined as collaboration, but such work and behavior will not violate collaboration principles.

Organizational governance

Organizational governance refers to the means that organizations deploy to influence organization members and other stakeholders to contribute to organizational goals and purposes (Foss and Klein, 2013) and the means by which the goals and purposes are determined. Organizational governance includes the notions of organizational control, corporate governance, and governance of key external dependencies (Pfeffer and Salancik, 1978; Shleifer and Vishny, 1997: 737; Sitkin *et al.*, 2010). Control in organizations is the setting of goals, monitoring and enforcement of goal fulfillment, allocation of resources, and distribution of rewards (Lebas and Weigenstein, 1986; Perrow, 1967; Pfeffer and Salancik, 1978). It is typically understood to entail the governance of the human capital within the boundaries of the organization (Foss and Klein, 2013) and involves combinations of input, behavior, and output controls (Cardinal, 2001; Kirsch, 1996; Ouchi and Maguire, 1975). There are links between different corporate governance modes and organizational architectures (Aoki and Jackson, 2008). Unless otherwise specified, in this document I use the term “governance” as shorthand for organizational governance.

Organization and organization design

I draw on March and Simon’s (1993: 2)⁴ conceptualization of organizations: “Organizations are systems of coordinated action among individuals and groups whose preferences, information, interests or knowledge differ.” Although other researchers have offered variations on this definition (e.g. Aldrich, 1979; Burton and Obel, 1984; Etzioni, 1964; Scott, 2003), some common characteristics remain (as synthesized by Puranam *et al.*, 2014: 163), portraying an organization as 1) a multi-actor system with 2) identifiable boundaries and 3) system-level goals (purpose) towards which 4) the constituent actor’s efforts are expected to make a contribution.

Puranam *et al.* (2014) propose that all organizations have to solve four universal problems: task division, task allocation, reward distribution, and information provision. Organization design is the principles, structures, processes, and infrastructures employed to solve these problems, fulfill organizational purposes and goals, and match environmental conditions

⁴ In the introduction to the second edition of their seminal book from 1958.

(Burton and Obel, 1998; Fjeldstad *et al.*, 2012; Galbraith, 1974; Thompson, 1967). The design process can be deliberate and emergent (Dunbar and Starbuck, 2006; Garud *et al.*, 2006; Kates and Galbraith, 2007; Mintzberg and Waters, 1985).

Hierarchy

Hierarchies are systems where units are ordered such that lower-level units are parts of, or subordinated to, units on the immediate higher level (Simon, 1962). In a strict hierarchy, no unit can have more than one immediate superior; this is the “unity of command” concept in organization theory (Gulick, 1939; Simon, 1946). Hierarchical organizations employ a set of structural principles for organizing tasks, authority, and information flows. A task hierarchy is the successive decomposition of tasks into more specialized ones that on the lowest level can be performed by an individual or a team (Simon, 1962). Authority hierarchy is where higher-level units have decision and conflict-resolution authority over lower-level units (March and Simon, 1958). Lower-level units may be delegated decision rights over certain domains and resources from higher-level units. Information flow and processing can also be hierarchical, implying that higher-level units have broader access to information and filter and communicate information relevant to specific subordinate units in the form of requirements, plans, rules, etc. (Galbraith, 1974; March and Simon, 1958). Subordinate units report operational information to superior units. An important design principle is to maximize intra-unit and minimize inter-unit interdependencies, i.e. to group together tasks that are highly interdependent and require extensive coordination (Thompson, 1967). Most major organizational forms, such as the functional, multi-divisional, matrix, and multi-firm network forms, are based on hierarchical principles (Chandler, 1962; Galbraith, 1971; Miles and Snow, 1986; Mintzberg, 1983). I do not specifically investigate hierarchy in this study, but rather discuss it in contrast to collaborative community forms of organizing.

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Methods⁵

In this study, I explore governance in collaborative communities across multiple dimensions including structure and process, micro and macro levels of analysis. This favors research approaches utilizing rich structural, processual, longitudinal, and contextual data in order to uncover potentially complex patterns and mechanisms (Barley and Tolbert, 1997; George and Bennett, 2005; Langley, 1999; Pettigrew, 1987, 1990; Van de Ven and Poole, 2005). I have chosen an exploratory multiple-case study design that is appropriate for such purposes (Eisenhardt, 1989; Glaser and Strauss, 1967; Graebner, Martin, and Roundy, 2012; Pettigrew, 1987; Yin, 2009). Multiple-case designs enable comparison that helps determine whether findings are particular to a standalone case or consistently replicated over multiple cases (Yin, 2009). Multiple cases provide a basis of more varied empirical evidence on which more robust theories can be built. They make it easier to determine the appropriate level of construct abstraction and develop more precise definitions (Eisenhardt and Graebner, 2007; Pettigrew and Whipp, 1991). Furthermore, recently calls for more comparative research on community organizing have been made (O'Mahony and Lakhani, 2011). A multiple-case study design can be combined with single-case studies, and if so, it provides the basis for case selection based on the deep understanding of a few cases. The overall design of this project is multiple-case, which is also reflected in Papers 1 and 3. Paper 2 is based on a single-case study and I will explain the rationale for the specific method choices per paper later in this section.

I have based the research process to a large degree on the process of building theory from case study research suggested by Eisenhardt (1989), which is inspired by Glaser and Strauss (1967), Yin (1981; 2009/1984), Miles and Huberman (1994/1984), and others. It consists of the following phases: 1) review literature and formulate research question; 2) conduct mapping of collaborative communities; 3) sharpen research question(s); 4) select cases; 5) craft instruments and protocols; 6) collect data on cases; 7) analyze data; 8) shape theory; 9) revisit literature and refine theory; and 10) synthesize and conclude. Although there is a logical sequence to these phases in the research process, several of them were conducted in parallel in an iterative fashion. This was particularly true for data collection, analysis, and early theory development, but also to some degree for case selection. Early findings in the first case informed the selection of subsequent cases consistent with a grounded theory approach (Glaser and Strauss, 1967). A more detailed discussion of each of the phases follows.

⁵ This chapter contains the most extensive description of the methods used in the dissertation project. As the methods and data are used across the three papers I wanted to reveal more details and discuss choices and tradeoffs more thoroughly here than the paper format allows. This implies that there are significant redundancies between this chapter and the methods sections of the three research papers.

Case selection

I identified and selected cases according to theoretical sampling principles (Glaser & Strauss, 1967) following a stepwise process: 1) mapping of collaborative communities; 2) definition of case selection criteria; 3) evaluation and shortlisting of prospective cases; and 4) case selection.

Based on an initial literature review and a working definition of collaborative communities, I started identifying empirical examples of collaborative communities in order to get an overview of the variation of forms across sectors and geographies and build an unfiltered longlist of prospective case studies. I have purposefully not sampled open source software (OSS) communities, which are one of the most common types of collaborative community. These are well-researched forms and I draw on the extant literature in this study (e.g. Benkler, 2002; Lakhani and von Hippel, 2003; O'Mahony and Ferraro, 2007). I identified and logged 70 potential collaborative communities by examining academic and practitioner literature, searching the Internet, and using personal and professional networks. All three search approaches generated leads, although the latter proved the most successful. I initially contacted a number of people, via email for the most part, and predominantly colleagues in the consulting company Accenture, asking them to identify potential collaborative communities and name knowledgeable people on the topic. Based on the responses I received, I conducted meetings in person, online, and by phone and snowballed new prospective cases and new contacts from each interaction. I contacted in total 114 people, generating 57 substantive responses with 30 prospective cases and 63 new contacts (included in total). The responding contacts were based in 22 cities in 11 countries across three continents (North America, Europe, and Asia) and represented a diversity of sectors and backgrounds. I conducted seven interviews and a large number of informal meetings and phone calls during the mapping phase.

I developed case selection criteria in two main iterations. Based on the initial literature review and intermediary results from the mapping, I developed an initial set of selection criteria upon which the first case was selected. On the basis of preliminary findings from the first case and a second round of literature review, I sharpened case selection criteria and applied them to the selection on the subsequent cases.

I selected cases based on similarity and variation on the following criteria. First, cases had to posit characteristics of collaborative communities as defined above, specifically 1) enabling networking, 2) autonomous and interdependent participants, 3) membership, 4) commitment to shared purposes, and 5) rules for participation. Second, I sought variation in terms of forms of collaboration and performance. Variation in forms of collaboration provided rich empirical settings for investigating governance problems. I sought performance variation in the case set to make possible the development of causal explanations of how governance and organization design influences performance. Third, variation in terms of geography, business sector, and performance mitigate cultural, industry and field, and success biases respectively. These are

common issues in business and organizational research (Baum, 2007). Finally, it had to be possible to study the cases over time—in real time and/or retrospectively—on actor and organizational levels in order to enable analysis of structuration processes (Langley, 1999; Pettigrew and Whipp, 1991; Stones, 2005). In addition, to ensure observability there had to be significant interaction and exchange in the case communities and participation had to involve more than a small team of members.

I evaluated and filtered the long list of prospective cases based on rough criteria after brief information gathering and screening of each case. Cases that matched high-level criteria underwent more analysis and through a selection process I identified and ranked a shortlist of prospective cases. Subsequently I approached an individual in a central organizing role in each of the most promising collaborative communities for an initial informational interview. This interview served two purposes: 1) data gathering and validation of match with selection criteria; and 2) relationship building and gauging interest in participating in the study.

After an evaluation, shortlisting, and validation process including screening interviews, I selected the cases. Four cases are included in this study. The cases are listed in Table 1 (in the order in which they were selected), which also indicates how they vary on key characteristics. The four cases represent the desired variation on the selection criteria specified above and the data collection and analysis process has given me reason to believe that theoretical saturation has been reached (Glaser and Strauss, 1967). More detailed descriptions of the cases are given in the three research papers. Even though each case went through the specified evaluation process, different cases could be at different stages in the research process at any time. Case identification and selection activities were ongoing for 1.5–2 years and I selected the first case before the three last cases were identified.

Data collection

The case studies involved interviews, participant observation, and documents; data collection techniques common for case studies (Yin, 2009). Multiple types of data from different sources inside and outside the community increase the robustness of results through triangulation (Jick, 1979). Multiple data sources are also necessary to cover events and processes in real time and retrospectively, unfold inner and outer context, and map actors, relationships, and structures (Pettigrew and Whipp, 1991).

Interviews

Interviews are a primary data source and have the advantage of obtaining multiple perspectives on events, processes, relationships, facts, outcomes, opinions, and emotions, as people have different roles, experiences, backgrounds, competencies, and interests. Furthermore, they enable collecting both real-time and retrospective data (Rubin and Rubin, 2012). The interview format is semi-structured, i.e. guided by a written interview guide ensuring focus on expected key topics and consistency across interviews. This eases comparison in the analysis phase (Kvale and Brinkmann, 2009). It is also a flexible format

that allows me to probe topics that are particularly interesting and about which the interviewee is particularly knowledgeable (Rubin and Rubin, 2012). There are two forms of interview guide targeting two discrete groups: community members/participants and community members in organizer roles.

I used a five-step interview process: 1) selecting interviewees; 2) booking appointment and preparing for the interview; 3) conducting and recording the interview; 4) transcription; and 5) coding (Kvale and Brinkmann, 2009). Interviewee selection was critical. I sought diversity of facts, experiences, and interests by interviewing a diverse set of people in and around each community. Key target groups included organizers; a variety of members or participants in terms of roles, backgrounds, seniority, centrality, competencies, etc.; and external stakeholders such as investors and observers. I identified and selected interviewees in cooperation with the key contact(s) in each case, typically asking them to introduce me to the interviewees. I attempted to overcome potential selection biases by asking different people for advice on whom to interview. In preparation for each interview I reviewed previous interviews, if the person had been mentioned, and searched the web for relevant information, such as LinkedIn profiles, to identify what they were knowledgeable about, their roles, relationships, etc. This formed a basis for topics and questions to focus on or add in each interview.

I conducted 75 semi-structured interviews with 83 people, 10–36 interviews per case. Fifty-six of the interviews were done in person and on site, and all were recorded and transcribed. Six of the OSDD interviews were group interviews, and six people across the OnCorps, LOHAS Asia, and OSDD cases were interviewed multiple times in order to trace development over time. Before the start of data collection I planned to conduct 10–25 interviews per case depending on case complexity and access. The number of interviews for the OSDD case goes well beyond this threshold (33 interviews with 54 interviewees). I chose to do this for several reasons: 1) the scale of the community; 2) the diversity of its participants; 3) the complexity of drug discovery; 4) the desire to do a thorough, single-case study of the community; and 5) unrestricted access.

All interviews were recorded and transcribed with the interviewees' consent. The project data management routines complied with Norwegian data privacy rules and were approved by Norwegian Social Science Data Services. The recording of each interview was transcribed by an external service provider.⁶ The interview transcripts amount to more than 1500 pages of single-spaced text. I listened to every recording, reviewed all transcripts, and made the necessary corrections. This time-consuming and robust process has ensured high-quality transcripts, upon which subsequent analysis is based. Finally, each interview transcript was coded (more on this in a later section on coding).

⁶ All interviews (65) for the OnCorps, LOHAS Asia, and OSDD cases were conducted in English and transcribed by an Indian provider. Most of the interviews (eight) in the DigiFam case were conducted in Swedish and transcribed by a Finnish provider, while the remaining two interviews were in Norwegian and were transcribed by a Norwegian provider.

Table 1 Overview of cases with key characteristics

Case	Collaboration		Value appropriation	Geo	Sector	Size (# members)	Performance
	Direct	Exchange					
OnCorps	(X)	X	Private	Boston, US	Enterprise IT	300*	Growing, potential
LOHAS Asia	(X)	X	Private (public)	Singapore, Asia	Sustainable products & services	900	Growing, potential
OSDD	X	(X)	Public	India, worldwide	Drug discovery	7900	High
DigiFam	X	(X)	Private	Stockholm, Scandinavia	Digital marketing & communication	100	Low, defaulted
Total	X	X	Private & public	3 continents, worldwide	4 major sectors		High to low performance

Legend: X = present, (X) = present to some degree. Geo: Hub city/country, geographical scope

* Fall 2011, end of stage “1.0”

Table 2 Data types and volumes

Case	# interviewees	# interviews	# onsite interviews	Hours:mins avg./total	# days observation	Virtual observation	Documents	Duration of study (mo)
OnCorps	7	11	5	1:21/16:09	Na	Limited	Yes	29
LOHAS Asia	12	16	9	1:07/19:02	Na	Yes	Yes	20
OSDD	54	33	32	1:13/43:37	8	Yes	Yes	20
DigiFam	10	10	10	1:39/16:25	Na	Na	Yes	12
Total	83	75	56	1:16/95:13	8	2/4	4/4	12-29

Research interviews have three general shortcomings (Van Maanen, 1979), which I believe I have been able to mitigate to a large degree. First, there is a researcher bias embedded in the set of questions being asked. Important topics that the researcher does not ask about often do not surface during interviews. I addressed this partly by ending each interview with an open-ended question probing for other relevant data.⁷ Second, consciously or unconsciously, interviewees frequently misrepresent data (Van Maanen, 1979). I have handled this issue through diverse sets of interviewees and triangulation with other data sources. Third, the interview setting is often outside the context being studied, exposing the researcher to the risk of misunderstanding or at least not fully understanding the meaning and importance of interviewee statements. I interviewed as many people as possible in their own context, i.e., in their office, lab, favorite café, etc. Introducing an element of ethnography with participant observation into the research design has mitigated some of the potential biases of interviews.

Documents

As far as possible, I collected documents on all the cases. Document types include contracts, process descriptions, vision and value statements, financial statements, membership lists, presentations for internal and external audiences, news reports, academic publications, and websites. I collected documents from all phases of the communities' lifetime, i.e., from foundation (or earlier) up to the time of study. The number and richness of documents available varied among the cases. In the DigiFam case I had full access to the electronic archives. On SysBorg 2.0, OSDD's online collaboration platform, all data and most of the interaction were logged and available. OSDD has also been featured in a large number of news reports and discussed in academic articles by authors within and outside the community.

Observations and field research

I have included some elements of observation in the study. During six field research trips over a total of seven weeks, I conducted the majority of interviews in person and in the context where the interviewees work and socialize. In the LOHAS Asia and OSDD cases, online collaboration spaces were available to study, where interaction was observed in real time and retrospectively. In the OSDD case, I conducted eight days of observation, five days in the project director's office and three days during an annual scientific review meeting with 60 participants who participated actively with presentations and in discussions. I made extensive field notes. The volume and types of data collected per case are summarized in Table 2.

Data analysis

There is an interaction between systematic analysis and intuition in making sense of, identifying patterns in, and generating insights from rich data in qualitative theory generating research (Glaser and Strauss, 1967). Systematic analysis in this context has two main purposes: uncovering patterns and insights from the empirical data and "testing" intuitively

⁷ From the interview guide: "Are there other topics you think are relevant that we have not talked about? Any questions I should have asked?"

induced theoretical insights from any stage of the research process on the empirical material (Eisenhardt, 1989; Pettigrew, 1987).

Coding and use of qualitative analysis software

All data, i.e. interview transcripts, field notes, and case documents, were uploaded in NVivo qualitative analysis software for coding and analysis. First-order coding is the systematic matching of text and other forms of data to categories of actors, functions, processes, events, and other theoretically relevant constructs. I combined inductive, deductive, and iterative approaches in generating, applying, and developing the coding system. First, I read some of the first interview transcripts and inductively identified categories from the text. Second, I synthesized a number of key constructs from a review of about 10 of the main theories informing organization design and governance.⁸ I wrote the categories from both lists on Post-it Notes that I stuck to a wall and gradually organized into four broad hierarchies of category: structural elements, coordination and control, evolution and dynamics, and outcomes. In using the coding system, I adapted and changed it iteratively as new categories were added, some consolidated, some moved, etc. I allowed for redundancy in the coding, e.g. the same bits of text could be tagged to multiple categories. All codes were listed and defined.

I conducted a small-scale test of coder reliability. Based on a predefined test protocol, a second coder recoded one interview.⁹ The overall inter-coder reliability was 93%, based on 41 instances of coding.¹⁰ The second coder recommended making no corrective actions after the test.

The use of NVivo qualitative data analysis software supported the analysis process in at least two ways. First it has an indexing function, which makes it easier to systematically search and analyze large volumes of textual data and avoid the ever-present danger of “death by data

⁸ Theories reviewed (with example references) include agency theory (Jensen and Meckling, 1976); information processing (Galbraith, 1974); transaction cost economics (Williamson, 1975); institutional theory (DiMaggio and Powell, 1983; North, 1990); commons (Ostrom, 1990); networks (Granovetter, 1985); resource dependency (Pfeffer and Salancik, 1978); relational view/alliances (Dyer and Singh, 1998); behavioral view (Cyert and March, 1963; March and Simon, 1958); and contingency theory (Thompson, 1967).

⁹ The second coder was a colleague at BI Norwegian Business School. An interview representative of the overall interview set was selected that followed the interview guide and covered multiple topics (1 hour 3 minutes duration, 29 pages of transcript). In order not to make test overly complex, the second coder was instructed to use one of the main branches of the coding system constituting about half of the categories (117 of 237 categories). He was introduced to the overall structure of the coding system and given a list of the selected part of the coding system with each category defined. I stayed in the room and was available for clarifying questions but did not interfere in the process. After the second coder completed coding the interview, we compared each instance of coding, and logged each instance with specific line references.

¹⁰ Specifically, 39% (16 instances) of coding were identical, 54% (22) were reconcilable differences, and the remaining 7% (3) were disagreements or errors and omissions by the first coder. Of the reconcilable differences 24% (10) were missed coding by the second coder, 10% (4) were instances where the first coder had applied more codes than the second coder, and the remaining 10% points (4) were definitional clarifications. All the reconcilable differences were instances where both coders had the same understanding of the content and deemed the first coder’s approach appropriate. The test took about four hours (excluding breaks).

asphyxiation” (Pettigrew, 1990: 281). Second, it brings rigor and traceability to sensemaking and theorizing from the case material (Sinkovics and Alfoldi, 2012). The study combined inductive and deductive logics in analysis and theorizing. Literature studies, data collection, coding, analysis, and theorizing were conducted in iterative cycles until theoretical saturation were reached, i.e. convergence on categories (Glaser and Strauss, 1967). Theory and data mutually informed each other and coevolved during the study (Van Maanen, Sørensen, and Mitchell, 2007).

Within-case analysis

I have written short case summaries for each of the cases and in the case of OSDD I have written a comprehensive case narrative describing the chronology of events, structural characteristics, actors and relationships, processes, and outcomes. Tools used in within-case analyses also include timelines of events and detailed process tables (example of the latter can be found in Table 1 on the drug discovery process in Paper 2).

Cross-case analysis

The cross-case analysis had two interrelated purposes: 1) to assist in uncovering patterns across cases that could be hard to see from a single case; and 2) to apply the theoretical constructs and relationships from one case or a subset of cases on the other cases validating the replicability of the findings. The latter is known as the replication logic and advocated by Yin (2009) and Eisenhardt (1989).

I used tabulation and visualization techniques (Langley, 1999) in data reduction and synthesis to explore and describe the cases and order and explain the findings (Miles and Huberman, 1994). In exploring and describing the cases I applied a number of techniques to assist in pattern recognition and matching. The process of applying multiple techniques and formats to the same sets of data has been a way of exploring different ways of organizing the data and making sense of them. The differing ease of applying the techniques and the meaningfulness of the displays gave strong indications about which patterns were a good fit with the data. The techniques for ordering and explaining the data were chosen on the basis of their ability to expose and explain the patterns and relationships found in preceding stages.

Let me give an example of the use of multiple tabulation and visualization formats from the development of Paper 1 (on agency problems and governance mechanisms). In the spring of 2012 I had started data collection on three of the cases, but had only conducted 12 interviews (of those reported here). The first draft of the taxonomy of community governance mechanisms was a visual representation of a tree structure with tick boxes indicating the presence of each mechanism for each of the three cases. I used the tree representation when presenting the ideas in the paper and it worked well as a communication device in oral presentations. In the process of writing up the first draft of the paper several months later, I also developed a more content-rich tabular representation. In the first couple of drafts of the paper I kept both representations, but because of the redundancy between them I decided to

merge them into what is now Table 4 in Paper 1. At the same stage I developed the simple diagram in Figure 1 in Paper 1 to illustrate the inverse relationship between two governance mechanisms, a relationship I discovered at an early stage but until then only had described textually.

Combining multiple and single-case methods

The overall design of this project is that of an exploratory multiple-case study for the reasons explained above. In Papers 1 and 3 I apply the same multiple-case approach and the full data set of all four cases. It proved valuable to make use of the variation and comparability of the four cases to explore the research questions of both of these papers. Even though the methods and data of the two papers are the same, the questions, theoretical lenses, and findings are very different.

For Paper 2 on the governance of complexity, we (i.e. my coauthor Øystein Fjeldstad and I) chose to do a single-case study of Open Source Drug Discovery (OSDD). OSDD is an ideal context for studying governance of complex problem solving in a collaborative community. First, drug discovery represents a highly complex form of problem solving, involving identification and validation of biological targets, mapping of structure-activity relationships, and identification, validation, and optimization of bioactive chemical compounds that may be used in therapeutic drugs (Civjan, 2012; Drews, 2000). It is an important societal sector impacting the health and wellbeing of the world's population and creates significant economic value. Second, OSDD represents a novel organizational approach to drug discovery with an open and diverse community rather than the secretive and hierarchical approach of conventional pharmaceutical companies. Finally, the unrestricted access I had, and extensive data collection that I conducted on that particular case, provided empirical data with the depth and breadth required to do an extensive, in-depth, single-case study on the topic.

Limitations and tradeoffs

Generally field study-based research such as case studies are considered to maximize realism at the expense of precision and generalizability (McGrath, 1982). More specifically, five common limitations and trade-offs with case studies have been identified (Eisenhardt and Graebner, 2007; George and Bennett, 2005; Graebner *et al.*, 2012): selection bias; limited ability to determine the size of causal effects; the risk of generalizing case-specific relationships; researcher and informant biases; and the trade-off between theoretical parsimony and explanatory richness.

In this study I have attempted to overcome such limitations and tradeoffs in several ways. First, I have mitigated potential selection biases through the theoretical sampling procedures described in the “case selection” section above. Second, I ask “how” and “what” rather than “how much” questions; this means that the effect size limitation of the method is not a problematic constraint for this study as the purpose is to investigate causal mechanisms and processes rather than the size of the effects. Third, the multiple-case studies approach I chose

implies comparing similarities and variation across cases. This increases the ability to identify boundary conditions and assess the transferability of the findings and the insights derived from them to other contexts, hence mitigating generalizability concerns to some degree. Fourth, the risk of researcher bias cannot be eliminated completely, but has been significantly reduced through the research design and process. A test of coder reliability was conducted with satisfactory results and the path from interviews to analysis is fully traceable through verbatim transcription of interviews and coding of all textual material in NVivo. The research papers have been sent to key informants for each of the cases for quality assurance¹¹ to further reduce the probability and degree of any potential researcher bias. I have mitigated informant biases by interviewing diverse sets of informants for each of the cases and triangulating with other sources of data, such as documents, news reports, and observations (Jick, 1979; Yin, 2009).

Finally, the tradeoff between parsimony and richness is to a limited degree determined by the research design and to a greater extent done in the analysis, theorizing, and writing stages of the research project. Still, there are discussions among case study researchers about “better stories” or “better constructs,” debating the virtues of single and multiple-case studies (Dyer and Wilkins, 1991; Eisenhardt, 1991). In a project like this, these are not mutually exclusive alternatives. A multiple-case approach allows for single-case studies when investigating particular research questions and in specific papers, as I have done in Paper 2 in this dissertation. The OSDD case displays novel governance issues and mechanisms in the rich and challenging context of drug discovery. This has allowed an investigation of mechanisms and processes richer in detail than might otherwise have been possible.

Reflecting on ontological, epistemological, and behavioral assumptions

My starting point for this study has been to attempt to understand the phenomenon of governance in collaborative communities. I did not enter the field with elaborate and definitive views on social theory and philosophy of science, rather a desire and need to make sense of complex issues and messy empirical data. As I was exploring the empirical data and applying different theoretical lenses I had to take their views of the world, knowledge, and people into account in my assessment. Reflecting on my observations, it became clear that in collaborative communities, social structure is both constraining and enabling action among participants and that it contains some strong institutional elements. It also was apparent that structure is not fixed, but dynamically shaped over time. I found these patterns to match structuration theory very well. This is explicitly expressed and discussed in Paper 3 on deliberate design and action, but it is also an implicit perspective reflected in the overall study.

¹¹ Written “research access agreements” with three of the four cases regulate quality assurance by key informants and the academic freedom of the researcher: “[Case organization] representative(s) will be invited to check facts and give feedback on case study drafts.” “The RESEARCHER will be granted full research freedom. Research findings and interpretations are made and presented by the RESEARCHER independently. The RESEARCHER is fully responsible for research findings and interpretations.”

Structuration theory views action and structure as mutually constitutive (Giddens, 1984; Parker, 2000). Structure, in terms of rules and resources, is both constraining and enabling action, and human action, by intent or not, is influencing structure, hence the notion of the 'duality of structure' (Giddens, 1976). "Structure is both medium and outcome of the reproduction of practices. Structure enters simultaneously into the constitution of the agent and social practices, and 'exists' in the generating moments of this constitution" (Giddens, 1979: 5). The process of structuration refers to recursive patterns of structure-action interaction in social practices situated in time and space (Giddens, 1984). The theory has a distinctive ontological position, both rejecting and integrating subjectivist and objectivist views (Stones, 2005). Actors are neither freely choosing their paths of action on a purely individual basis, nor is human action determined by social structure. Human beings are knowledgeable agents who "know a great deal about the conditions of reproduction of society" (Giddens, 1979: 5) and are able to "act otherwise" and "make a difference" (Giddens, 1984: 14). This corresponds well with the community participants I observe in the case studies. Participants are highly knowledgeable within their domains and reflexively monitor their own and other's actions. They take entrepreneurial action, which is enabled and constrained by community values, rules, and infrastructures.

The structuration lens is not directly applied to Papers 1 and 2 and subscribing to structuration theory is not a necessary condition for those studies. In Paper 2 on collaborative drug discovery, structuration patterns can be observed, particularly in the discussion on experimentation and the emergence of governance. Agency theory in its original form is a functionalist and positivist theory (Fama, 1980; Jensen and Meckling, 1976); however I build on newer and more "social" conceptions of agency (e.g. Lubatkin *et al.*, 2007; Wiseman, Cuevas-Rodríguez, and Gomez-Mejia, 2012) which are compatible with the overall ontological position of this project.

Giddensian structuration theory is ontologically oriented and shows a relative neglect of epistemology (Stones, 2005). My epistemological position is close to that of critical realism, a social theory paradigm compatible with structuration (Bhaskar, 1993; Stones, 2001). Critical realism views the world as both objective and subjective reality. Archer (2000) proposes three orders of reality, i.e. natural, practical, and social orders, with corresponding forms of knowledge; embodied, practical, and discursive knowledge, respectively. Knowledge of the outside world will be imperfect and not always possible to attain. Critical realists aim "to identify and understand the underlying structures, capacities, mechanisms, etc. which causally bear upon (facilitate, influence, produce) surface phenomena" (Lawson, 1997: 233). This is consistent with Papers 1 and 2's focus on governance mechanisms and Paper 3's focus on structure and agency.

Social systems such as organizations consist of people, and behavioral assumptions are essential to studies of such systems. In each of the three research papers I use distinctly different, but complementary theoretical lenses in the form of agency theory, cognitive/

problem-solving perspectives, and structuration theory. Taken together, in this study I view human beings as knowledgeable (Giddens, 1984), bounded rational actors (March and Simon, 1958; Simon, 1947), with potentially different interests and information asymmetry among them (Jensen and Meckling, 1976; Wiseman *et al.*, 2012). This is consistent with March and Simon's (1993: 2) conceptualization of organizations: "Organizations are systems of coordinated action among individuals and groups whose preferences, information, interests or knowledge differ."

Concluding remarks on methods: Increasing the potential for discovery

In this project, I set out to explore governance in collaborative communities. Initial literature studies showed that our understanding of the phenomenon was quite limited and that most relevant empirical studies were specific to the domains of natural resource commons and OSS communities, where the latter is an important, but special case of the broader phenomenon of collaborative communities. I have aimed to study and understand this broader phenomenon. This is reflected in the case selection, both the initial broad mapping of communities and the selection of the four cases. The extensive (but not exhaustive) mapping provided a broad overview of the field and gave me a sense of the most active sectors and common forms. This provided a solid basis for the selection of the case set. In that process I tried to balance variation and comparability.

Scientific discovery is a form of complex problem solving (Simon, 1992). Discovery processes imply recursive cycles of variation and selection (Ashby, 1960; March, 1991), that is, generation of variation in knowledge elements and solution alternatives and effective selection between alternatives (Henderson and Stern, 2004; Knudsen and Levinthal, 2007; Simon, 1993). Large variation is particularly important in complex, ill-structured, problem solving as there is no way of predicting with certainty which elements will constitute the final solution. I have deliberately generated within- and across-case variation. First, the four cases vary in terms of business sector, the problems they solve, and their geographical footprints; nevertheless, as collaborative communities they share key organizational characteristics. Second, the volume of data and diversity of data sources and informants per case have generated within-case variation. The large volumes of rich, varied, qualitative data within relevant contexts for the phenomenon in focus provided a great setting for discovery.

Scientific discovery also entails extensive search across (all or some of) four spaces, i.e., hypothesis, experiment, representation, and strategy spaces (Klahr and Dunbar, 1988; Klahr and Simon, 1999; Schunn and Klahr, 1995). In these searches I have combined structured and intuitive approaches. First, I have applied multiple theoretical lenses and explored alternative explanations (hypothesis space) over multiple iterations in making sense of the data. Second, I have collected large amounts of diverse empirical data through a time-consuming and elaborate process of field studies, interviews, and desk research (experiment space). The interview process illustrates how structure and intuition interact. From a structural perspective I based the interviews on a prepared interview guide. The interviews were recorded and

transcribed. I did quality assurance on the transcripts, uploaded them to the NVivo analysis software, and coded the transcripts. In the process I “experienced” the interview data in three different ways: first, in the live interview I interacted with the interviewee, listened to what he or she was saying, watched body language, noted the surroundings, smelled the ambient odors of the setting (very real in some of the chemistry labs I visited), asked probing questions, and improvised. Second, I listened to the recording, read the draft transcript, and wrote my corrections. Third, I reread the transcript and applied codes. Both the structured, robust process and the different ways of experiencing the data were essential in making sense of them and discovering patterns within and across cases. I attempted to capture these data, patterns, and findings in textual, tabular, and visual formats (representation space). I reiterated these searches countless times throughout the research process.

Finally, I attempted to validate and assure the quality of my research design, data, and findings by obtaining reviews from case contacts, friends, colleagues, and presenting at academic conferences. I believe that the process I set up and executed has created significant potential for discovery in terms of generating a new understanding of governance and design in collaborative communities. The remainder of this dissertation will show if I have been successful in both generating and realizing such a potential.

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The papers of this dissertation (pages 48-170) are not available in BI Brage, due to copyright matters:

- Paper 1:
Agency problems and governance mechanisms in collaborative communities
- Paper 2:
Collaborative drug discovery: Governing large-scale distributed problem solving
Co-authored with Øysetin D. Fjeldstad
- Paper 3:
Deliberate design and action in collaborative

A complete version of the dissertation (print copy) may be ordered from BI's website:
<http://www.bi.edu/research/Research-Publications/>

Conclusion

In this concluding chapter I integrate and discuss the findings and implications from the three research papers of this dissertation. First, I summarize the findings. Second, I synthesize and discuss implications and issues for further research identified in the research papers and point towards some promising alleys of research beyond the scope of this study. Third, I discuss implications for practice. Finally, I make some concluding remarks.

Summary of findings

In Paper 1 I study collaborative community governance through an agency lens and I find that agency relationships in collaborative communities are characterized by three distinct multiple agency structures: commons, team production, and brokering. These are governed by means of four main categories of mechanisms: 1) Mutual monitoring, enabling self-regulation and peer-based control; 2) member selection, regulating admission to the community; 3) values and rules, guiding member action and collaboration; and 4) property rights and incentives, regulating rights to community resources and distribution of rewards. The governance mechanisms mitigate the source conditions of agency problems—information asymmetry and differential interests—in different ways. I also identify contingencies among governance mechanisms and performance. First, the extent of mutual monitoring is inversely related to the strictness of member selection, as these are alternative modes of quality control. Second, community performance is contingent upon values, rules, incentives, and their enforcement. An inadequacy of these increases agency problems and the risk of failure.

In Paper 2 we investigate governance of large-scale complex problem solving. Based on our study of Open Source Drug Discovery (OSDD) we explore an organization design conducive to discovery and complex problem solving. Specifically, we identify five mechanisms, which together enable governance of large-scale collaborative complex problem solving: 1) protocols for searching and broadcasting, which guide exploration and sharing of problems and findings; 2) means of identifying and amplifying promising problem solving (or problem state) pathways; 3) structured commons that enable effective sharing of heterogeneous problem-state representations and problem-solving resources; 4) openness and transparency, enabling diversity, self-assignment, and peer-based control; and 5) incentive structures supporting concurrent creation of participant and community benefits from exploration. Combined, these mechanisms allow for the generation of great variety and broad evaluation. The scale of the community provides diversity and capacity, which together enable increased search breadth and depth. OSDD takes an experimental approach to designing and calibrating its own governance mechanisms. It solves complex problems and is itself a complex system where micro-level behavior generates system behavior in a non-simple way.

In Paper 3 I study the content and process of organization design and the role of deliberate design and action in collaborative communities. I trace the structural properties and process patterns and advance a structuration perspective of the process of community design,

identifying two distinct structure-action patterns: 1) experimentation—testing alternative design options in practice and challenging structural constraints through deliberate action; and 2) institutionalization—the process of community values, rules, and incentives becoming increasingly taken for granted over time. Community design, in terms of institutional architecture and infrastructure, shapes and is shaped by participant behavior. Such structuration processes span across micro-level human behavior and community-level structures and practices over time. The communities are characterized by positive externalities which play out in two distinct forms: expanded opportunities for collaboration, sharing, and exchange from increased participation (i.e. direct network effects) and a self-reinforcing gravitational effect from resource commons becoming more attractive to use and contribute to as they grow (i.e. resource gravity). The positive externalities are supported by design mechanisms such as formalization of rules, transparency, collaboration and knowledge-sharing infrastructures, and structuring of commons, which enable and enhance connectivity and scalability in the communities studied here. The community designs emerging through rich structuration processes support self-organization and do not necessarily converge toward hierarchy.

This study has explored how collaborative communities are governed and designed. Papers 1 and 2 investigate governance challenges arising from agency problems and complex problem solving, respectively, and the governance mechanism used to mitigate these challenges. The third paper frames organization design as a structuration process where structure and action are mutually shaping each other over time and I identify a set of structure-action patterns and the mechanism driving them. Taken together the papers cover three major analytical dimensions in studying community governance: 1) governance issue; 2) structure and process; and 3) level of analysis (see Table 13).

Table 13 Analytical dimensions covered in the research papers

	Governance issue			Structure & process		Level of analysis	
	Problem	Mechanism	Behavior/outcome	Structure	Process	Macro	Micro
Paper 1	X	X		X		X	
Paper 2	X	X		X	X		X
Paper 3		X	X	X	X	X	X

Implications and issues for further research

Across the papers, the communities—despite their differences—are all primarily governed by means of institutional mechanisms in terms of values, rules, and incentives that together enable large-scale peer-based coordination and control. Rules are specified beyond the general level into social and technical protocols for communication, collaboration, and problem solving. Rule compliance and quality assurance are predominantly enforced through mutual monitoring practices. Extensive networking in operations and governance reinforces

community values and rules and accelerates institutionalization processes. Such institutionalization yields stable “rules of the game”, but does not generate operational rigidities or converge toward hierarchy; rather the contrary, stable institutions enable self-organization and entrepreneurial action among participants in the communities studied here.

In the research papers I identify a number of implications and issues for further research. In this section I synthesize these implications and issues, as well as outline some new. I discuss implications for the domains of organization design, governance and agency theory, complexity and bounded rationality, commons and resource-based strategies, and institutions. I also outline some possible implications for community leadership and entrepreneurship.

Organization design

Any study of governance in organizational settings is also a study of organization design. My study contributes to the literature on organization design and has some important implications for that field of study. First, the study contributes to our understanding of the content and process of organization design. In contrast to conventional hierarchical forms, the locus of organizational design is shifted from an authority structure to the principles for organizing, i.e. values, rules, and incentives (Fjeldstad *et al.*, 2012; Ostrom, 1990). Communities have strong emergent properties as community structure, behavior, and outcomes are generated from self-organized participant behavior in a non-simple way (Garud, Jain, and Tuertscher, 2008). Paper 3 identified structure-action patterns in community design and operations. The content and process of design cannot be viewed in isolation as community structure and participant action mutually shape each other over time. I found structuration theory (Giddens, 1979, 1984) to be a useful lens for studying this interplay and believe that it could be useful for other researchers to pursue as well. My study has merely scratched the surface of community design processes and we need better understanding of these as well as the contingencies influencing structural properties and processual patterns.

Second, the study highlights the role of technology and infrastructures in community design and governance. Infrastructures provide spaces for collaboration and sharing of knowledge and other resources among community participants (Fjeldstad *et al.*, 2012; Ostrom and Hess, 2006). They have both enabling and constraining properties. Information and communication technology (ICT) is a key factor enabling distributed collaboration in three of the four cases of this study, a finding which resonates well with findings from OSS communities and broader societal trends (Castells, 1996; Lerner and Tirole, 2002; Scacchi, 2002; Zammuto *et al.*, 2007). OSDD’s innovative and extensive use of ICT enables large-scale distributed collaborative problem solving and facilitates the creation, maintenance, and use of structured commons of heterogeneous resources. The OSDD case also highlights how core values and rules—particularly protocols—such as transparency and open peer review are embedded in the technological infrastructures (Lessig, 1999; Orlikowski, 1992). Still, ICT is not a necessary condition for collaborative communities to emerge and operate. DigiFam is an example of this, where shared office facilities were the key infrastructure. My analysis of the community’s

demise shows that the relative lack of community ICT infrastructure was not a major contributing factor to its failure, rather imbalances in the institutional architecture combined with challenging market conditions. The role of physical and virtual infrastructures in collaborative communities and other organization forms is a fertile ground for further research.

Third, collaborative communities are characterized by positive externalities (Bonaccorsi and Rossi, 2003; Harhoff, Henkel, and Von Hippel, 2003) in terms of direct network effects and the gravitational properties of commons. The positive externalities are supported by design mechanisms such as formalization of rules, transparency, collaboration and knowledge-sharing infrastructures, and structuring of commons, which enable and enhance connectivity and scalability. In fact, formalization of rules and scalable infrastructures support large-scale self-organization and transparency, rather than bureaucratization as in hierarchical organizational forms. The positive externalities appear to contribute to both expanded operational opportunities (Gulati, 1999; Harhoff *et al.*, 2003; Uzzi, 1996) and institutionalization processes as complying with a set of rules becomes increasingly rewarding and the failure to do so increase the probability and consequences of community sanctions (North, 1990; Owen-Smith and Powell, 2008). There is a need for more research on how organization design enables, enhances, and constrains positive externalities in communities, and if these effects and mechanisms are particular to such contexts or applicable to a greater variety of organizational forms.

Governance and agency theory

Paper 1 documents that agency problems exist in collaborative communities and need to be mitigated. They are based on different agency structures than the well-known principal-agent structure (e.g. Jensen and Meckling, 1976) and require a different set of governance mechanisms. The study contributes to the multiple-agency literature (e.g. Arthurs *et al.*, 2008; Holmstrom, 1982; Varian, 1990) by identifying and elaborating three such structures—commons, team production, and brokering—and how they interplay. Agency relationships in collaborative communities are multiplex, dynamic, and embedded. Community participants are both principals and agents. As agents they contribute to fulfill community and other participants' needs and requirements according to shared values and rules. As principals they request contributions from other participants, peer-review contributions, and influence the direction, practices, and rules of the community. A similar principal-agent duality is observed among community participants in organizer roles. They act as principals in shaping rules and roles, specifying tasks, and performing monitoring and quality assurance tasks, but are agents in brokering roles between other community participants and in stewarding commons and infrastructures on behalf of the community. Further exploration of the multiplexity, dynamism, and embeddedness of agency relationships in communities, as well as identifying possible contingencies for and configurations of community governance mechanisms are promising directions for future research.

Complexity and bounded rationality

My findings, and particularly Paper 2 on large-scale complex problem solving in OSDD, support the assertion that collaborative community forms are well-suited to address ill-structured problems (Fjeldstad *et al.*, 2012; Simon, 1973). The ability to dynamically mobilize self-organizing constellations of community participants provides collaborative communities with sensing and adaptive capabilities, improving the potential to thrive in complex and dynamic environments.

This implies a different way of handling the problem of bounded rationality²⁷ than what is commonly found in hierarchies. The hierarchical response to complexity is the successive decomposition of complex problems into problems and tasks simple enough for human agents to accomplish and the coupling of the task structure with a managerial hierarchy where supervising actors govern the activities and resources of subordinate actors across multiple levels (Simon, 1962). The task decomposition structure and the corresponding management structure are stable and formal (Sabel, 2006). A hierarchical logic is valid under the condition of relative stability; when supervisors are capable of decomposing complex tasks into simpler ones for subordinate organizational members to execute; the implicit assumption is that supervisors are more competent than subordinates in making choices about their work. Under conditions of volatility, when no one knows the full answer to a complex problem, and when organizational members are frequently more competent in their field of expertise than organizers, the decomposition of tasks and the assignment problem have to be dealt with differently (Sabel, 2006). Effective complex problem solving requires the creation of shared cognitive maps and search heuristics, as no individual actor is capable of independently developing sufficiently accurate representations (Fleming and Sorenson, 2004; Gavetti and Levinthal, 2000; Walsh and Fahey, 1986), which is an organizational capability documented in the study of OSDD.

Paper 2 shows how OSDD is mitigating several known issues in organizing and governing problem solving; including spanning and combining multiple knowledge domains within and across organizational boundaries (Hansen, 1999; Jeppesen and Lakhani, 2010; Utterback, 1974); generating variety and effective evaluation and selection—organizational capabilities that are difficult to combine (Henderson and Stern, 2004; Lee *et al.*, 2004; March, 1991; Utterback, 1971); and enabling and structuring concurrent and interdependent problem solving involving large numbers of participants, teams, and organizations (Kazanjian, Drazin, and Glynn, 2000; Thompson, 1967: 158). We highlight how community protocols enable and guide participants' individual and collective problem-solving efforts in a self-organizing fashion (Fjeldstad *et al.*, 2012). Our study is based on the case of an ongoing large-scale collaborative problem-solving effort, the final outcomes of which we do not know; hence we cannot make strong claims for generalizability. There is a need for more comparative research on similar organization designs to develop refutable propositions on governance mechanisms,

²⁷ Bounded rationality refers to human behavior as “intendedly rational, but only limited so” (Simon, 1976: xxviii).

contingencies, performance, and boundary conditions for community-based complex problem solving.

Commons and resource-based strategies

In line with previous studies on collaborative community organizational forms (e.g. Benkler, 2002; Fjeldstad *et al.*, 2012), I find commons to be an important element of such designs. However, the size and importance varies across my four cases; from DigiFam where common resources were scarce to OSDD where the commons are very elaborate and central to its design and operations. OSDD's commons comprise a heterogeneous set of physical and intangible resources. They are structured in ways that enable effective sharing of heterogeneous problem-state representations and problem-solving resources by means of rules and infrastructures that set submission, storage, and retrieval standards and procedures. These structures facilitate quality assurance, resource use and combination, and become increasingly important with growing resource scale and heterogeneity. Findings on commons structure and resource heterogeneity complement the literature on commons in general (Ostrom, 1990, 2009), and knowledge commons in particular (Lee and Cole, 2003; Ostrom and Hess, 2006). The literature on commons of natural resources suggests that small, homogenous communities are more likely to be able to sustain a commons (Cardenas, 2003; Ostrom *et al.*, 2002). The OSDD case suggests that a large and diverse community is conducive to building growing and sustainable knowledge commons and problem-solving capabilities, which is consistent with findings from OSS communities (Benkler, 2002).

The study has implications for the organization of knowledge resources and resource-based strategies. It contributes to our understanding of the organization of knowledge resources, the lesser studied element of Barney's VRIO (Value, Rareness, Imitability, Organization) framework (Barney, 1995, 1996). Knowledge resides in the knowledge commons and in knowledgeable participants. The organization shapes how knowledge resources are accumulated, maintained, retrieved, and combined; hence it enables and constrains knowledge use and the value creation from it. The cumulative and evolutionary nature of commons matches classical accounts of the resource-based view (e.g. Dierickx and Cool, 1989; Penrose, 1959). However, the openness and transparency of crucial resources in commons stand in contrast to the focus on non-imitability and appropriability of firm-controlled resources through e.g. property rights protection in central resource-based works (Barney, 1991; Wernerfelt, 1984). Commons increase in value by being widely available as they attract new contributions (Benkler, 2002); hence non-imitability is achieved by superior resource gravity and network effects rather than secrecy. There is a need for more research on the sources and growth trajectories of resource-based organizational advantages and deeper understanding of governance in communities as critical resources and interdependencies span organizational boundaries.

Institutions

The findings across the three research papers of this dissertation highlight the importance of organization-level institutional mechanisms in enabling and regulating community participation and contribution. Formalized rules and protocols guiding collaboration and sharing coupled with transparency make communities less dependent on social cohesion as the basis for trust. This provides the foundation for scalable designs that enhance self-organization and adaptiveness. Hence, governance of collaborative communities is practiced primarily through institutional mechanisms, in contrast to authority-based mechanisms in hierarchical organizational forms (Fjeldstad *et al.*, 2012: 746). These organization-level mechanisms are analogous to macro-level institutions governing markets and resource commons (North, 1990; North and Wallis, 1994; Ostrom, 1990). Institutional architecture can be viewed as an organization-level equivalent of the field-level construct of institutional logic, referring to the constellation of beliefs and associated practices (the schemas and scripts) that the actors in a field hold in common (Friedland and Alford, 1991; Lounsbury, 2007; Owen-Smith and Powell, 2008: 602).

Institutional architectures have to be adapted to the context they are used (Hess and Ostrom, 2003; Ostrom, 2009; Ostrom and Hess, 2006). Papers 2 and 3 highlight the emergence of governance and the process of design in the communities. The process influences the design outcome and the effectiveness of the design. Rules, unlike physical constraints, have to be understood and deemed legitimate by participants to be effective (Ostrom, 2000: 152). Case findings suggest that the strong presence of network effects in communities accelerates the pace of institutionalization processes (Owen-Smith and Powell, 2008), and either enhances the effectiveness of institutional governance mechanisms (North, 1990) or lock-in to inefficient solutions (Arthur, 1994) depending on the congruence among mechanisms and their appropriateness for the context. Studying the formation of institutions as structuration processes (Barley and Tolbert, 1997) provided me with a good vantage point to capture both institutionalization pressures and human agency yielding path dependent (Arthur, 1994; Sydow, Schreyögg, and Koch, 2009) and path creation patterns (Garud and Karnøe, 2001; Garud, Kumaraswamy, and Karnøe, 2010), respectively. I believe my study has contributed new insights to this area, but we certainly need deeper understanding of institutions-based governance in collaborative organizational forms and the conditions and practices shaping the design and emergence of institutional mechanisms.

Implications beyond the scope of this study

In addition to the findings and implications discussed in the research papers, the data and investigations of my study points to possible implications and promising alleys for future research beyond the scope of the research papers of this dissertation. I would like to highlight two such areas: leadership and entrepreneurship in collaborative community contexts. First, the lesser importance of formal authority (despite its existence) compared to hierarchical organizational forms accentuates the significance of other bases of leadership and governance. Leadership is vital in the operation of governance (McAlister and Ferrell, 2005), so also in the

collaborative communities investigated in this study, but with different characteristics than in conventional hierarchical designs. Preliminary observations indicate that community leadership is based on the 1) shaping and maintenance of institutional architectures and infrastructures; 2) stewardship of community commons; 3) mediation of contact and resources among participants; and 4) mobilization of attention and resources towards strategic priorities. Furthermore, leadership processes are also an interesting area of study. Findings indicate that selecting leaders by appointment could be ineffective or even counterproductive in some settings. The emergence of leadership seems to be rather organic as leading participants take responsibility, show initiative, excel in operational and managerial tasks, and gain legitimacy from peers. Collaborative communities are interesting contexts for studying leadership that is not based on hierarchical authority. Studies in this area could contribute to our understanding of collaborative leadership practices in communities and possibly also in other organization forms.

Second, I have followed the development of all four cases before, during, and after their founding through retrospective questions in interviews with founders and early members and through documents from the same periods. These reveal fascinating stories of entrepreneurship, big ideas, and experimentation. All four lead founders are visionary and charismatic people with large professional networks and the willingness and ability to mobilize these networks. Still, they appear to differ in their ability to attract and empower community organizers with complementary capabilities and ability to develop and steward sustainable institutional architectures and infrastructures. This is a fertile ground for research on entrepreneurship improving our understanding of the processes, capabilities, and contingencies of community entrepreneurship, as well as enriching the broader entrepreneurship literature.

Implications for practice

The study has implications for managerial practice in terms of organizing learning and problem solving, designing institutional architectures, and conducting strategy and design processes. First, the four communities organize discovery and problem solving largely in a self-organizing fashion based on shared values and rules with extensive experimentation and rapid feedback cycles. This represents a novel approach to enable and enhance organizational and individual learning. Experimental learning is effective under conditions of complexity, uncertainty, and dynamism as accurate forecasting and long-term planning is inept in such settings (Brown and Eisenhardt, 1997). Such approaches appear to be very useful as predicting the outcomes of particular initiatives in communities are very difficult given factors such as participant autonomy and positive externalities. Furthermore, an increasing number of organizations, such as consulting companies and research labs, have complex problem solving as their primary mode of operation. Such organizations have other strategic and organizational characteristics and challenges than the archetypical industrial manufacturing firms that so much of management theory and practice is derived from (Stabell

and Fjeldstad, 1998; Thompson, 1967). Paper 2 on collaborative problem solving identifies mechanisms for governing non-hierarchical distributed problem solving that may be applicable for organizing collaborative efforts in problem-solving organizations.

Second, the fundamental values and constitutive rules have to be formulated with care in early stages of a community's development due to the potentially rapid institutionalization of these elements. The institutional architecture has to provide a basis for motivating participation and create a sustainable balance between contributions and benefits. This is imperative for community entrepreneurs and early stage community organizers to pay attention to. There are, however, no universal recipes for how to design the institutional architecture as it has to match the community purpose, the nature of problems and tasks, the participant characteristics, and the cultural and institutional context.

Third, strategizing and designing are ongoing processes intermeshed with operational work, rather than occasional analysis and design activities secluded from operations and operational participants. In principle, anybody can be a designer and a strategist in collaborative communities, as any member can make contributions with strategic and organization design implications. Still, the leadership roles of community organizers are important. In organizing autonomous and knowledgeable participants community organizers are challenged to lead by mobilizing community members to contribute, connecting complementary people and resources, and facilitating strategy and design processes.

Concluding remarks

The growing number and importance of collaborative communities (Heckscher and Adler, 2006; Snow *et al.*, 2011), and more generally the move from hierarchical to more collaborative organization forms (Child and McGrath, 2001; Daft and Lewin, 1993; Fjeldstad *et al.*, 2012; Lewin and Volberda, 1999), is creating new opportunities and challenges. Opportunities include enabling and enhancing knowledge creation and combination, problem solving, innovation, and commercialization (Adler, Kwon, and Heckscher, 2008; Lee and Cole, 2003; Snow *et al.*, 2011), but communities also have to deal with challenging governance issues. In this dissertation I highlight governance issues stemming from agency problems and complexity—specifically complex problem solving—such as challenges related to multiple actors sharing valuable resources in commons, collaboration in teams, facilitation of contact and exchange between actors, establishing and sharing shared representations of complex problems, and mobilizing and coordinating autonomous actors towards shared ends.

The communities of this study are primarily governed by means of institutional mechanisms in terms of values, rules (protocols in particular), and incentives that together enable large-scale peer-based coordination and control. Their organizational designs and design processes are characterized by the positive externalities inherent in their networks of participants and resource commons. These externalities are accommodated by design mechanisms involving formalization, technical infrastructures, and resource structures that together enable

community scalability and connectivity, without imposing hierarchical rigidities. Design processes play out in structuration patterns as community structures and participant behavior mutually shape each other over time.

Community designs are highly adaptive and conducive to collaborative exploration, problem solving, and service delivery—organizational capabilities in high demand in today’s complex and rapidly changing environment. Such organizational forms challenge established notions of organizational structures, strategy and design processes, and leadership skills and practices rooted in the hierarchies of the industrial era. My hope is that this study will trigger new questions, inspire further research, and inform practice in the field of community governance, organizing, and strategy.

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