Information Systems Research

Online Community as Space for Knowledge Flows

Samer Faraj, Georg von Krogh, Eric Monteiro, Karim R. Lakhani

Online Community as Space for Knowledge Flows

Samer Faraj
Desautels Faculty of Management, McGill University, Montréal, Québec H3A 1G5, Canada, samer.faraj@mcgill.ca

Georg von Krogh
ETH Zurich, 8092 Zurich, Switzerland, gvkrogh@ethz.ch

Eric Monteiro
Department of Computer and Information Science, Norwegian University of Science and Technology,
7491 Trondheim, Norway, ericm@idi.ntnu.no

Karim R. Lakhani
Harvard Business School, Boston, Massachusetts 02163, klakhani@hbs.edu

Online communities frequently create significant economic and relational value for community participants and beyond. It is widely accepted that the underlying source of such value is the collective flow of knowledge among community participants. We distinguish the conditions for flows of tacit and explicit knowledge in online communities and advance an unconventional theoretical conjecture: Online communities give rise to tacit knowledge flows between participants. The crucial condition for these flows is not the advent of novel, digital technology as often portrayed in the literature, but instead the technology's domestication by humanity and the sociality it affords. This conjecture holds profound implications for theory and research in the study of management and organization, as well as their relation to information technology.

Keywords: online community; community of practice; epistemic community; value creation; knowledge-based view; knowledge creation; innovation; tacit knowledge; organization theory; organizational knowledge creation theory; organization form; knowledge sharing; digital technology; digital platform; open source software

History: Published online in *Articles in Advance* December 1, 2016.

Introduction

In the past two decades, a range of new information and communication technologies, broadly characterized as Web 2.0, have fundamentally altered the nature of community building, collaboration, and organizing in economic and social life. An online community (OC) brings together large numbers of geographically dispersed individuals in support of an activity, interest or identity. They are the scene of novel forms of organizing for innovation and knowledge creation, leading to increased scrutiny and participation by organizations of all types, including firms, nonprofits, governments, and spontaneously formed groups. As OCs have grown in number and membership, so has academic interest in their nature, organization, governance, processes, and what motivates people to contribute knowledge and sustain communities made up primarily of online strangers.

If OCs represent new forms of organizing (Fjeldstad et al. 2012, Fulk and DeSanctis 1995, Zammuto et al. 2007), there is a need to research them as complex settings where serious work gets done and effective collaboration at a hitherto unseen scale can emerge. OCs are the scene of wide-ranging efforts in knowledge creation, extending into product, service or process inno-

vation (Blohm et al. 2016, Haefliger et al. 2011, Holmström and Henfridsson 2006). They are increasingly seen as sites for unconventional knowledge collaboration and innovation (Faraj et al. 2011, Majchrzak and Malhotra 2016, Yan and Tan 2014). They exist alongside, but frequently break through the boundaries of, traditional organizations and open lateral streams of rapid, unfettered knowledge flows (von Krogh 2012). Their output and production process are often recognized as radical innovations with far-reaching implications for economy and society (Harhoff and Lakhani 2016). Yet, the OC phenomenon is outpacing the speed with which we conduct our scholarly inquiry. At this advanced stage of technological and social development, surprisingly little is known about OCs and how they create value in a range of fields such as open innovation, health support, rare diseases treatment, human genomics research, knowledge remixing, eScience, citizen science, composing, authoring, and crowdsourcing.

A key challenge for research on OC and other digitally enabled new organizational forms is to understand the sources of the value creation that undergirds their raison d'être (Amit and Zott 2001,

Haefliger et al. 2011). Value creation is a fundamental concept that encompasses the economic value from products and services as well as the use value as perceived by participants themselves (Bowman and Ambrosini 2000, Lepak et al. 2007). While OCs certainly play an extensive role in augmenting the economic value in transacting products and services, such value creation presupposes an active and vibrant OC with engaged participants (Barrett et al. 2016, Bauer et al. 2016). An emergent and related question is whether OCs are essentially novel as forms of organizing or are just variations on classical organizational forms and thus can be analyzed through a traditional lens of task decomposition, coordination, and control via information flows (see Puranam et al. 2014). Nonetheless, there is a growing consensus to view OCs as network forms of organizing or peer production spaces (Benkler 2006) that differ from markets or traditional hierarchies in creating value.

We conjecture that OCs create value for their participants by embedding them in the process of establishing, nurturing, and shaping spaces for knowledge flows. Thus, we emphasize subjective use value, defined by participants in relation to how useful they find the OC as a source of knowing. We will argue that the "secret" of how to create use value is found in the sociality of OCs. In so doing, we consider OCs as fluid organizational forms that are effective for sustaining knowledge collaboration, leading to innovation and other value creating activities, and requiring new forms of governance (Faraj et al. 2011, O'Mahony and Ferraro 2007, O'Mahony and Lakhani 2011, Shah 2006, von Krogh and von Hippel 2006). To more clearly emphasize OCs as sites of knowledge creation, we offer the following definition: OCs are collective spaces of knowledge flows characterized by a continuous morphing and are mutually constituted by digital technologies and participants. Such a definition moves away from the mainly social realm of information sharing and making and sustaining social ties, and work that posits OCs as vehicles for pure economic value creation. It suggests that OCs are not merely social communities or automatically generated by digital technologies, but rather that they emerge when participants focus their interactions on sustaining knowledge flows. Space may appear to be an unconventional notion, but we use it here to underscore the collective nature and the fluid topology in which social practices of interest emerge. Thus, space is a digital realm in which participants choose to dwell and engage in online activities.

Our goal in the remainder of this paper is to establish how OCs provide a generative landscape to sustain collaborative relations on a hitherto unknown scale and offer novel opportunities to create knowledge and value. Our main theoretical conjecture is that OCs can be spaces for tacit knowledge flows among participants, which is to say that OCs allow participants to share hard-to-codify knowledge such as competence and experience, which are typically transferred via observation and imitation rather than writing or speech, even in the absence of shared physical space. Unconventional as this theorizing may appear to organizational scholars, even those with a strong interest in technology, we think it is warranted by the ease with which participants today socialize by enrolling digital technologies, and a trend to "domesticate" novel technologies—making them a natural part of everyday life.

Current Perspectives on Online Communities

Taking stock of OC research in the information systems (IS) field is necessary for four reasons. First, existing IS research on OCs has primarily focused on why people participate in OCs. The analysis level has often been the individual and their cognitive processes as they come face-to-face with the phenomena of OC. A number of explanations have been offered including various dimensions of extrinsic and intrinsic motivations, utilitarian and reputational reasons, commitment drivers, and identity aspects (Bateman et al. 2011, Kankanhalli et al. 2005, Ma and Agarwal 2007, Ren et al. 2012).

Second, much less is known about the activities of members, the inner workings of communities, or the processes and technologies that support them. Many OCs are sustained by the work of a small group of dedicated members that form a core that contributes content and protects the boundary of the community, with a much larger group of individuals lurking or sporadically contributing information (Butler et al. 2007, von Krogh et al. 2003). Recent lines of inquiry have emphasized the social capital and social practice aspect of community engagement (von Krogh et al. 2012, Wasko and Faraj 2005).

Third, research on OCs has become increasingly reliant on large data sets and analysis of information and other resource flows. Invariably, research of this type favors an overly structural perspective where actors and actions are represented by network position, frequencies of ties or inference from linked others (for an excellent review, see Sundararajan et al. 2013). Yet, a strictly structural perspective may not reveal the full dynamics of OC with its multiple layers of actors and activities. It may well describe the information that is being shared and created in an OC, but falls short of revealing the antecedents and trajectories that explain why the content emerged in the first place.

Finally, OC research may be confounded by the phenomena of digital platforms as well as by the growth

of social media. For all these reasons, it is time to take stock in OC research and offer some convergent suggestions as to how research on them may proceed in the future. Whether it is in open source, open innovation, open science, customer communities or user communities, much attention has focused on why people engage with and participate in these OCs where they typically do not know the other participants.

Given the importance of contribution behavior, researchers have extensively studied the motivational factors that lead to user OC participation (e.g., Lakhani and von Hippel 2003, Markus et al. 2000, Nambisan and Baron 2010, Ray et al. 2014, Stewart and Gosain 2006, von Krogh and von Hippel 2006, Wasko and Faraj 2005). Scholars have identified a diverse set of factors that drive contribution behavior ranging from economically-driven extrinsic motives to psychologically-based intrinsic motives and sociologically-driven pro-social motives. Whether the attachment is focused on the group and what it symbolizes or the attachment is due to a bond formed with specific members can affect commitment to the OC (Ren et al. 2007). Specifically, psychological identification with the OC has been found to be a key driver of contribution behavior (Hertel et al. 2003, Ma and Agarwal 2007, Spaeth et al. 2015) with some OCs sustained by ideologically committed individuals (Stewart and Gosain 2006) or, at the least, affectively committed participants (Bateman et al. 2011). Some members were driven by the opportunity to learn (Lakhani and Wolf 2005), the joy of helping others (e.g., Kankanhalli et al. 2005), a strong sense of community belonging (Blanchard and Markus 2004, Hertel et al. 2003, Shah 2006), self-efficacy goals (Ray et al. 2014) or wanting to build a reputation among peers or generate career signals (e.g., Hann et al. 2013, Lerner and Tirole 2002). While it was long believed that pecuniary (extrinsic) rewards offered could inevitably "crowd out" the efforts of pro-socially or intrinsically motivated individuals (Osterloh and Rota 2007), studies showed that extrinsic and intrinsic motivation frequently interact to produce even more effort by participants than intrinsic motives alone (Lakhani and Wolf 2005, von Krogh et al. 2012). In summary, research on OC has concluded that participants in OCs are driven by varied and complex sets of intrinsic, pro-social, and extrinsic motivations that impact decisions to participate, levels of effort, and continued engagement.

Other drivers of participation relate to the social factors that may affect OC dynamics and knowledge contribution. It is often assumed that OC participants aim to be recognized as experts by socially meaningful others—especially when the contributed knowledge is visible for all to see. Participants in OCs often have ties with many online participants and are conscious of the benefits that network position can bring in terms of enhanced expertise and reputation (Dahlander and Frederiksen 2012). In their study of an immigration lawyers' community, Wasko and Faraj (2005) found that participants were embedded in the social structure of their community and that social capital building goals played a major role in their behavior online. Analyzing the contributions and values of open source developers, von Krogh et al. (2012) found that participants identified with the open source ethos, values, and practices. Such identification leads to a set of expectations and obligations to release code on time, strive for excellence, and sustain the community. Overall, a sense of embeddedness in an OC's social practice may increase knowledge sharing with and/or assistance to less expert others (e.g., Lakhani and von Hippel 2003).

Thus, repeated interactions, contributions, and exchanges can lead to the emergence of a social structure akin to that of a community of practice. Recently, Levina and Arriaga (2014) have argued that OCs can be conceived as social fields with positions of power due to network position such that a graduated status hierarchy is at play. Like other fields of social production, OC members seek to acquire measures of distinction by taking on various roles or contributing strategically. Such framing builds on ideas of social practices and social fields that are common in the sociology of knowledge production (e.g., Bourdieu 1977), and is in line with views of OCs as dynamic spaces of collaboration. OCs are characterized by a fluidity in terms of organizational form, boundaries, norms, participation, technology, and foci (Faraj et al. 2011). This fluidity can be generative and allow the OC to be an attractor via the efforts of its committed members, the passion its focus generates, and the roles available for the taking, or more precisely, for the making. Compared to traditional forms of organizing, OCs are both highly social and continuously changing forms of organizing. How does organizing characterized by continuous morphing and open boundaries evolve a capacity to create knowledge and value? Answering this question requires that we may need to leave some established conceptions of OCs behind.

What Online Communities Are and Are Not

To date, there is no single agreed upon definition of communities, let alone OCs (Brint 2001, O'Mahony and Lakhani 2011). Traditional definitions of community recognize a dual nature for the term: either as a space that binds individuals to a geographic locale or alternatively as an attractor built on a commonality of bonds, desires, shared features, or common interests (see Minar and Greer 1969). These twin definitional metaphors of a locale and commonality are

reflected in two commonly accepted definitions of OC. Kraut and Resnick prefer the imagery of a place when they define OC as a "virtual space where people come together with others to converse, exchange information or other resources, learn, play, or just be with each other" (Kraut and Resnick 2012, p. 1). Others have preferred to emphasize the convergent commonality of shared experience, condition, goal, and conviction that creates a common interest in the collective welfare (Sproull and Arriaga 2007).

A common limitation of research involving online interactions is the conflation between the enabling technologies known as social media with the more social phenomena of the OC. Social media is the set of technologies that are designed to facilitate new forms of social connectivity that are traceable and transparent (e.g., Majchrzak et al. 2013, Treem and Leonardi 2012). The OC may rely on social media but is not solely constituted by it. Social media can support communities and their interactions, and facilitate community emergence. However, the main focus of social media is on individual networks and the ties users have built up. For example, no two individuals on Facebook, Twitter or LinkedIn have the same set of ties: each individual has a different network and connections.[1] These same individuals have some control over who is part of their network. They can, on their own, decide to "unfriend" or "unfollow" someone, thus rapidly reshaping their network. In OCs, it is much more difficult for one individual to ban or exclude another. Banning participants would typically require decisions by the collective or a group of representatives (e.g., Wikipedia). Thus, a community would be governed by broader social and collective action considerations compared to individual networks.

A second conflation is the reduction of OCs to the underlying digital platform. It has not escaped organizational researchers, especially those from the IS field, that digital platforms offer a unique set of capabilities to match participants (primarily organizations and individuals) via platform facilitated connectivities (Gawer 2009, Tiwana et al. 2010). Digital platforms create economic value through the network effects brought about by a large number of participants (buyers/sellers, producers/consumers) that find the platform useful to engage with and accommodating to their transaction needs (see also Evans et al. 2006, Hann et al. 2016, Parker and van Alstyne 2005). Because platforms are digital in nature, they take advantage of Application Programming Interfaces (APIs), modularity, scalability, and malleability to offer responsive functionality to host a diverse user population. Thus,

digital platforms connect large populations of interacting users and offer tools to facilitate knowledge recombination leading to unexpected and novel knowledge generation. As a result, digital platforms have been described as inherently generative because their value emerges from the interplay between the possibilities for action offered by the underlying technology and the evolving needs of the participants (Boudreau and Lakhani 2009, Lyytinen et al. 2016, Yoo et al. 2012, Zittrain 2008).

We suggest that attributing the label of generativity to digital platforms may conceal the importance of the presence of a vibrant OC, and potentially overlook the necessary conditions for an OC, which are participant behavior and social interactions. At its extreme, the same platform in terms of features will or will not be generative—create subjective use value—dependent on the actions of participants (see Kohler et al. 2011, Lindberg et al. 2016). Just like social media, digital platforms may become homes of vibrant social interactions that are at the core of the value created. Thus, a more comprehensive approach through the lens of OCs requires equal attention to be paid to both the social aspect as well as the technology shaping the innovation and participation. Neither platform nor social media are generative in themselves, but are mutually constituted with the sociality evolving on them. In the next section, we explain how OCs are uniquely characterized by an extended sociality that can sustain traditional and novel knowledge flows among participants.

The Evolving Sociality of Online Communities

Because OCs rely on digitally enabled communication among a distributed set of participants, their "narrower means" of communication is often compared to the gold standard of traditional, face-to-face interactions. This regularly leads to observations that virtual interactions fail to mimic fully face-to-face—for instance, it is difficult to observe or comprehend substitutes for body language, emotions or gestures (e.g., Olson et al. 2002). Yet, rather than focusing on what gets lost in virtual interactions compared to face-to-face, there are rich and interesting forms of sociality and community formation emerging in OCs, complementary to those in offline settings. It is, we find, more rewarding to understand the surprising width and depth of sociality unfolding in OCs than to focus on what they fail to accomplish. Sociality, or the tendency of people to seek related others, build social ties, and organically assemble, emerges as a defining aspect of the OC space.

Indeed, the very notion of an "online" community suggests a clear separation from ordinary "offline," physical communities. This separation reflects a dichotomy that is increasingly difficult to uphold as an

---

[1] Of course, both Facebook and LinkedIn offer group functionality for their users. However, individual features dwarf group features and governance of those group features is still tied to an individual.

ever-increasing percentage of the population are digital natives having only known a life where "online" is at hand. We are witnessing a large-scale naturalization of the abilities and affordances of OCs to forge novel types of collaboration and sustain new modes of sociality. OCs are accordingly subject to what cultural theorists have dubbed "domestication," i.e., the gradual taming or taken-for-grantedness of new technology (Cummings and Kraut 2002, Hirsch and Silverstone 2003). Domestication is an effective term for capturing humanity's taken-for-granted coexistence with and codependence on technological artifacts. Thus, with increasing domestication, "instead of 'using' technology, we should look at ways to explore how we live with technology" (Monteiro 1998, p. 249). For a rapidly growing portion of the world's population, there is a gradual dissolving of the on/offline distinction in many areas of activity, and an increasingly seamless life with the emerging possibilities of online sociality. As a result, digital technologies become increasingly adapted and appropriated in ways that are in line with social needs and preferences.

In turn, this domestication of the technological artifacts used in sustaining online social life lead to an increased transfer of social relations to the online setting. Today, OCs sustain novel types of sociality that enable the collection, integration, and remix of knowledge in potentially more effective ways than many traditional organizations. Crucially, online sociality has aspects that assist collective endeavors and collective action such as locating gatherings of interest, connecting with groupings of similar relevant others, and enabling easy community formation and generative engagement with others on a global scale (see Zittrain 2008). As OCs are increasingly easy to connect to, engage with, and support the collaboration of the many, online sociality has positive and unique organizing affordances with regards to knowledge creation. We specifically focus on three of them: fluidity in membership, swift trust, and an epistemic orientation.

First, membership fluidity recognizes the fundamental characteristic of OCs as a changing form of organizing, morphing while retaining their recognizable form (de Laet and Mol 2000, Faraj et al. 2011, Law 2002). Compared to traditional forms of organizing, OC boundaries are less clearly established. In OCs, it is challenging to determine who is a member of the community and who is not. Some individuals may lurk invisibly for long periods while others promptly move to the core (Phang et al. 2015, von Krogh et al. 2003). Barriers to entry and exit are relatively low on the periphery of the OC, allowing an ebb and flow in terms of participants. Fluidity is advantageous because porous boundaries, flows of participants, norms in the making, visible interactions, and evolving task or topical foci can lead to a greater inflow of resources (Faraj

et al. 2011). Fluid membership can also act as a powerful attractor. It allows participation by a mix of people who are driven by a diverse range of motivations, some of whom work on their own free time while others as part of their corporate work responsibility. This easy and flexible form of participation can yield a number of unique advantages for knowledge creation.

Within traditional organizations, employment contracts govern members' expected knowledge sharing and creation. What each individual contributes and integrates into the "knowledge pot" serves some higher-level organizational goal, such as efficiency or innovation (Felin and Hesterly 2007). Within the context of any hierarchical organization (e.g., firm) employees thus face binding constraints in terms of what decisions they can make and what activities they can participate in. They are incented to stay focused on task and roles defined within the organization hierarchy, and to contribute within the confines of existing governance channels. Firms often struggle to strike the right balance between various incentives that motivate individuals' to share their (tacit) knowledge and create entirely new insights and ideas (e.g., Osterloh and Frey 2000). This is why some organizations recognize the impediment of organizational structure and formal roles on knowledge sharing and seek to offer features resembling a social community where members contribute to mutual learning (see Brown and Duguid 1991, Kogut and Zander 1992).

By contrast, in OCs, the limitations of formal roles, organizational hierarchy, and intellectual property concerns dissolve. Tasks tend to be self-designed by participants rather than by an external authority. A heterogeneous populace unbound by rigid organizational norms joins willingly and seemingly effortlessly to share a practice, build a solution or just deepen their knowledge on a topic. The apparent freedom from organizational constraints enables some to take on tasks and roles in an OC that would be difficult to achieve in a "real" organization. The open structure of OCs allows participants to create roles for themselves either as subject matter experts or as organizers of collective efforts (Zhang et al. 2013). OCs in effect become driven by participants' skills and interests, and can form easily and rapidly as soon as a critical mass of motivated participants comes together. Thus *self-selection* by participants with diverse motivation and their ability to select role, task, and effort is a key enabler (Lakhani 2016) of OC fluidity. Conversely, the OC participants can migrate en masse and leave a platform that has been perceived to slight them as was recently the case with a migration from Digg to Reddit (Tassi 2012).

Second, a facilitating aspect of OCs is the ease with which a rapid form of trust—labeled swift trust—can form in online contexts (Jarvenpaa and Leidner 1998).

While technology mediated communication has limits on what social information can be shared (see Walther 2007), trust in teams and groups does seem to develop online in spite of the lack of physical copresence (Alavi and Leidner 2001). One reason for trust development may have to do with the number of like-minded others available for supporting the shared enterprise or the goal of the community. Primarily due to the anytime-anywhere access, OCs attract orders of magnitude more participants than any face-to-face counterpart. Another reason may be the freedom from the hindering effect of local organizational controls and hierarchy. Swift trust may evolve into a form of sociality, in the sense of rapidly engaging into social interactions and collective action, and appears to come fairly easily for digital natives. With the availability of digital platforms that can be utilized to sustain a community, it is relatively easy to gather a large group of participants in a community characterized by a flat organizational structure.[2] A swift form of sociality seems to take hold based on repeat interactions, shared goals and passion, and belonging.

Third, the most important factor behind the vibrancy of OCs is their nature as epistemic communities that support some form of social practice. Beyond the socialization bond (Ren et al. 2007), OCs do best when they are focused on developing and sustaining a social practice. This mutual engagement is what gives the OC its coherence and focus. Many communities are about some complex topic or developing some hard to excel at competencies. Members hold each other mutually accountable for the knowledge being produced. Like in any organizational setting, they engage in dialogue with the aim of validating knowledge, setting contextual conditions, and deepening shades of distinctions (e.g., Dejean and Jullien 2015, Tsoukas 2009, Wenger 1998). Thus, through these social yet knowledge-focused interactions, a regime of mutual accountability develops. The espoused goal is to converge on an accepted repertoire of "justified true beliefs" or a "ways of doing." Yet, the heterogeneity of participation, the ever-changing mix of topics, questions, and expertise all lead to a continuous knowledge mixing and communal engagement. Much learning does take place as newcomers find ways to engage with more expert participants. Through questions, refinements, and discursive challenges, meanings get continually negotiated, shades of differences clarified, and flows of knowledge accelerated. Through repeated interactions, community members gradually assume the community identity, become connected

through a history of interactions, develop a specialized language, assume certain boundary roles and coordinative positions, and come to naturally view their engagement in the social practice as requiring the training of new members. As a result, OCs can be sites for participant engagement, not merely of the kind seen on the much heralded face-to-face communities of practice, but also offering extended knowledge production of a new kind (see von Krogh et al. 2003). Such a development has implications for a theory of knowledge creation which we explore further in the next section.

Knowledge Creation Online
In this section we will argue that OCs enable effective and efficient knowledge creation. We build on past work on organizational knowledge creation (e.g., Nonaka 1994), and contend that systematic knowledge creation is a process of participants contributing and augmenting elements of knowledge, crystallizing and connecting these to the OCs evolving collective knowledge (Nonaka and von Krogh 2009).[3] New knowledge creation, an essentially creative process, is often depicted as the interplay between the individual's internalization of explicit knowledge, externalization or codification of tacit knowledge, socialization around tacit knowledge, and combination of explicit knowledge (Alavi and Leidner 2001, Nonaka 1994, Nonaka and von Krogh 2009). In the past, many scholars have elected to focus on recombination as the dominant mechanism of value creation (Almeida and Phene 2004, Fleming 2001, Gruber et al. 2013, Kogut and Zander 1992), and innovation is often thought to originate in unprecedented combinations of ideas, technologies or organizational routines (e.g., Nelson and Winter 1982).

Clearly, OCs are ideal for facilitating the flow of explicit knowledge across time and space (Chiu et al. 2006), which makes them particularly amenable to knowledge recombination (Nonaka and Konno 1998). Yet, we think additional, richer knowledge creation processes can emerge in OCs, which create exceptional value for participants and keep them highly engaged (see Faraj et al. 2011). Based on the increasing sociality of OCs described in previous sections, we stipulate that OCs are increasingly sustaining an expanding flow of tacit knowledge among participants.[4] These

---

[2] One form of participation is via the use of anonymous identity that buffers a "real" world identity and frees the user from the confines of titles, organizational membership, and the constraints of representing one's employer (Ross 2007).

[3] The definition recognizes that not all knowledge on OCs is that of the participants, but that a significant portion of what the OC contains is codified knowledge, such as software code, documents, manuals, and other sources of information.

[4] Early work offers preliminary support for this conjecture. In the context of traditional organizations with face-to-face interactions, studies have shown how technology may mediate the sharing of tacit knowledge between members with interrelated tasks (Vaccaro et al. 2009, Alavi and Leidner 2001, von Krogh 2012).

Figure 1   How Online Knowledge Creation Is Affected by Increased Sociality
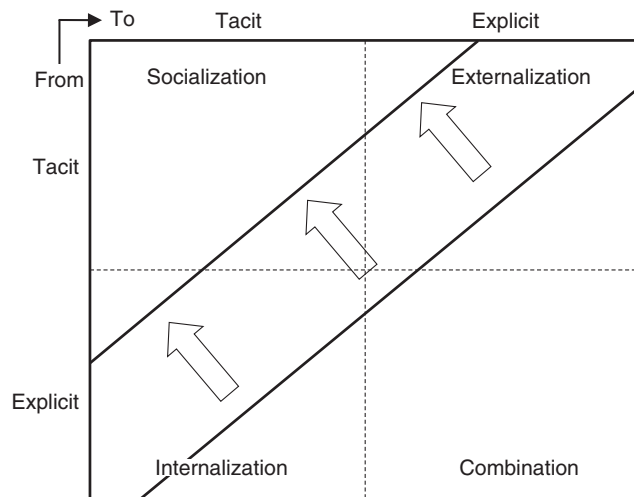
Source. Adapted from Nonaka (1994, p. 19).

knowledge contributions extend beyond participants' personal contributions, learning, and interactions and are reliant on the community's enriched sociality and facilitated by technological tools for information representation and collaboration.

All knowledge that involves humans has an underlying tacit component (Grene 1977), although not all knowledge necessitates human presence (Nonaka and von Krogh 2009). Thus, for practical purposes scholars often focus on either the explicit (e.g., patents) or tacit (e.g., craft) ends of a knowledge continuum. While expedient in many research settings, a static focus on these extremes may miss out on some of the dynamic flow along the continuum, which after all is how new knowledge originates. Such flows can be rapid and effortless as when we solicit some practical advice from a friend on how to book a nearby tennis court, or it can be slow and elaborate as when we watch an instructor play a game and next try to imitate some first hits with the racket. Below we argue how OCs nurture a myriad of knowledge flows that in their totality generate new knowledge and create value. Figure 1 presents a graphical representation of how sociality-induced online knowledge flows are extending the possibilities of online knowledge creation.

Explicit → Explicit
OCs are germane to a combination of input knowledge in a codified form (Nonaka 1994). On OCs such flows display four distinct features. First, participants contribute individual knowledge elements, retrieve available elements (e.g., previous posts, FAQ documents) from the OC's knowledge system, and recombine them to fit their own immediate needs (Fleming 2001). OCs make such explicit-explicit flows instantaneous and efficient, and their provision and

augmentation occurs independently of the time and place of the original elements creation. For example, in open source software development, participants often find it valuable to mix what they are currently working on, their own software, with modules developed within the collective at earlier points in time (e.g., Lakhani and von Hippel 2003).

Second, when crystallizing and connecting individual elements to the evolving knowledge system, most OCs offer search functionality that provide participants with efficient ways to find relevant elements or other individuals of interest. The available repositories, media, and platforms make the sharing of new combinations nearly costless. Limited cost of sharing in turn fosters frugality in knowledge creation, by facilitating extensive reuse of existing knowledge elements (Haefliger et al. 2008).

Third, as was argued in the previous section, many OCs display open boundaries and fluid membership. Compared with more restrictive offline settings, OCs gain substantial advantages from the number of engaged participants and the diversity of their background, interest, and expertise. OCs also broaden the range of challenges that can be addressed in conversations, and preserve these exchanges for long periods of time. The amalgamation of input knowledge, its immediate capture and augmentation, exposes OC participants to extensive and unpredictable explicit-explicit flows. Such expanding and unpredictable flows may explain why OCs often display a capacity for radical—not merely incremental—innovation (see Bogers et al. 2010, Bonaccorsi et al. 2006, Osterloh and Rota 2007).

Fourth, in OCs knowledge is typically perceived as a public good that benefits participants and beyond. The non-rivalry and non-excludability of knowledge (e.g., safeguarded through creative commons licenses, free software/open source licenses, see Singh and Phelps 2013) enable participants to sustain an unfettered explicit-explicit flow, which in turn instills their deeper sense of value that can be extracted from working with their peers (Wen et al. 2013). A recent field experiment showed that participants in OCs tend to adjust their knowledge contributions contingent on the peer comparison, typically leading participants contributing less than the mean to adjust their contribution level upwards (Chen et al. 2010). OC administrators often use this mechanism to accelerate knowledge creation. For example, some software development platforms offer trackers on individual contributions across projects. OCs tend to evolve a culture of sharing and remixing in which participants experience extensive satisfaction from the continuous discovery of novel and surprising insights, ideas, and solutions (Stanko 2016).

Tacit → Explicit

An individual's tacit knowledge is a crucial source of new explicit elements (Nonaka 1994), be they creative ideas, concepts, personal statements, lines of argument, systematized facts or algorithms. We think OCs offer four distinct characteristics of tacit-explicit flows that set them apart from other offline contexts.

First, a primary challenge for off- or online knowledge creation groups alike is to overcome knowledge differences that originate in people's varied backgrounds, experiences, and different means of communication (Majchrzak et al. 2012). While communication is constrained by technology, OCs perform a subtle constructive function that facilitates the tacit-explicit flow. To encode their experiences, participants explore and exploit language and other means already at hand in the collective. Offline settings do this too, but there communication is transient and forms of expression are often lost. In OCs linguistic and other means of communication evolve into valuable and often specialized repositories that allow highly efficient participant interaction. For example, GitHub, the software development platform, has evolved an official glossary that enables millions of participants to converge on common terms when codifying ideas, programming, and connecting their contributions to the knowledge systems of their OCs. Clearly, an established glossary prevents online cacophony—the confusion and ambiguity in communication that would easily transpire in such a global crowd of diverse individuals.

Second, OCs, like most epistemically oriented communities, develop a specialized language with jargon, acronyms, and descriptions that allow efficient communication of concepts and ways of doing. Over time, participants learn to externalize experiences within the horizon of the OC. This learning is not simply targeting the use of a specialized jargon but rather how to play the "language games" underlying the process of knowledge creation (Astley and Zammuto 1992, Boje et al. 2004, Boland and Tenkasi 1995, Wittgenstein 1953). For example, a structural engineer who wants to get involved in an online drone-design community (e.g., at Local Motors) may observe how specialized language evolves to describe a variety of wing designs, who uses what terms, and in which context. In this example, the engineer may learn a lot from observing how the community's moderator uses specialized language to describe the wing in multiple question-and-answer sessions with the community. Over repeated interactions, they may gain insight on how to frame problems, how to question assumptions, and what specifics are emphasized in the convergence toward an answer. The engineer may also be exposed to different pockets of expertise and come to realize how wing design impacts the electrical and electronic components of the aircraft. In general, language games provide a necessary context to express any concepts or ideas rooted in experience, and over time they become deeply and commonly understood and accepted within the OC (see Fayard and DeSanctis 2010, Johnson et al. 2015).

Third, specialized language is often a requirement for deeper knowledge interactions to take place. While many OCs (e.g., GitHub) may have their glossaries at hand, some OCs also linguistically evolve at "Internet speed" as participants play with new vocabularies to communicate. Novel language games become a resource for people to experiment with ways to externalize tacit knowledge elements and share them beyond the immediate constraints of a "contemporary glossary." Sociality is a necessary condition for language games to evolve in this manner. For example, when new terms emerge from community interactions, they can be added to the glossary with a proper explanation and will be gradually adopted by the community.

Fourth, an OC is a social field with a position of influence and power (Levina and Arriaga 2014) or social capital at play (Wasko and Faraj 2005). This motivates people to externalize their expertise to solidify their position of influence. This sociality also encourages the development of norms by which experts are expected to help newbies. Also, here language games may play a role since they oftentimes reflect an underlying social structure with power and status. At the same time, depending on individual preferences, members may be satisfied with their role and position in the community and choose not to advance "up" the ladder or be "promoted," as compared to formal organizations. This means that deep topical expertise is developed, nurtured, and sustained within the OC.

Explicit → Tacit

Explicit-tacit flows are often described as learning by doing (Nonaka and Konno 1998). In OCs such flows capture participants' evolving interpretations, understandings, and practicing of explicit knowledge, picked up and refined from the OC's knowledge system. Ideas, concepts, problem formulations, solutions, needs or algorithms flow continuously through the community and individuals need to select and incorporate them into their own, personal tacit knowledge. Three aspects mark such explicit-tacit flows in the OCs.

First, OCs make available to participants a large and dynamically evolving stock of explicit elements. This creates a challenge for participants who need to "navigate" the OC system by learning about relevant knowledge that gradually evolves through peer to peer interactions. The expansive flows in OCs represent a cognitive challenge for individuals to identify the most relevant information to fit their needs. Confronted with complex, evolving knowledge systems, a

participant needs to conserve scarce human attention to specific information sets, which is a fundamental purpose of digital technology (see Simon 1997). Allocation of attention processes are well documented in studies of online behaviors showing how individuals selectively search and learn (e.g., Bhargave et al. 2016, Browne et al. 2007). Understanding search behavior is thus imperative for explaining the explicit-tacit flows on OCs.

Second, peer interactions shape the participant's overall understanding of the OC dynamics, which itself constitutes valuable tacit knowledge. Many interactions on OCs take the form of evolving Q&A threads where unclear knowledge elements get refined in such a way as to allow a deeper understanding to emerge among the participants of the thread. Over time, and benefiting from social validation, these explicit knowledge elements enrich and get integrated in the participant's mental schema. By contrast to an offline setting, OC participants gain access to massive peer interactions that extend beyond the social relations that are available face-to-face. With time they can benefit from a map of who is who and who knows what. Such mapping is a prerequisite for effective interaction in knowledge creation, and serves to identify new knowledge elements, as well as to structure and choose among them.

A special feature of OCs is that they afford participants temporal flexibility in selecting not only what to learn but also when to internalize explicit knowledge elements. Selecting the right moment in time—making a snapshot of relevant elements—requires some level of understanding of how the OC evolves its knowledge system. For example, deciding at what time to learn from a project development tutorial requires that an individual make an assessment of how other participants orchestrate their current and future contributions. In sum, a key to understanding the explicit-tacit flow is to examine what people learn from the OC, but also to figure out how other members simultaneously imagine their own community so that they can choose what and what not to learn, at which points in time.

Third, trust is a general factor in the choice of knowledge to internalize (Nonaka et al. 2000), and as discussed in the prior section, swift trust is characteristic of online settings. In OCs, the identity and credibility of knowledge sources relate to participants' decision to use them (Forman et al. 2008) and central figures, such as opinion leaders, may play a particular role as such trusted sources (see Goes et al. 2014). Opinion leaders often develop a "trusted status" based on the type of past activities performed (e.g., reviewing) and the growing number of people who utilize knowledge they contribute (Lu et al. 2013). In communities where software code or other technical objects are being designed, swift trust can also be attained through a direct technological assessment. Instead of relying on social cues and credibility signals, participants will often simply run the code or test the object to verify the claims of the contributor. This enables relative newcomers to rapidly contribute to the project and ascend within the community ranks.

Tacit → Tacit

Thus far we have argued that knowledge flows in OCs involve the explicit end of the knowledge continuum. In the following, we shall argue that OCs permit tacit-tacit flows too, even though the communication between participants is chiefly mediated by digital technologies.

First, the exchange of tacit knowledge can only occur via intense engagement in the social process. When observing a thread of online conversations, the activities therein may seem mundane, but repeated interactions, the possibility to ask contextualizing questions, the validation of answers, the mutual challenging of partial answers, the presentation of an idea, and its further refinement through dialogue gradually shape participants' comprehension of what is going on. Above all, in spite of most communication being on public display in OCs, repeated interactions bring forth a more profound understanding of some significant other participants, towards whom one may orient and fine-tune communication. Repeated interactions also bring forth experts, often recognized by badges, reputational ratings, or contribution volume indicators or other implicit markers, who become important sources of advice in knowledge production. Over time, OC sociality enriches knowledge flows by creating goodwill, social capital, norms of direct and generalized reciprocity (Faraj and Johnson 2011, von Krogh et al. 2012) or a culture of helping others (Lakhani and von Hippel 2003).

This sociality, developed without the necessity of physical copresence, offers unique advantages for tacit-tacit flows. While an OC may not be an appropriate space for sharing deep embodied knowledge of offline tasks and activities (e.g., how to ski down a hill at great speed, how to select the best red wine in a blind taste test or how to keep equilibrium while riding a bicycle), it offers increasing opportunities for classes of problems that are amenable to digital representation, discourse, interaction, and narrative. Indeed a range of tasks that require cognitive skills may be best learned in an online setting.

Online advice is often provided in the form of stories that carry rich meanings. Brown and Duguid (1991) seminally described how service technicians shared personal insights and experience by telling each other detailed problem fixing stories during coffee breaks. Today, OCs emulate such processes but reach an unprecedented scale of narrators and narratives.

Through the OCs' newfound sociality, the meanings attached to online storytelling may be as rich—if not even richer—than those in face-to-face settings. Offering advice by rendering some personal experience typically generates a massive chain of comments, supplementary advice and stories, additional contextualization, qualifiers, and clarifying questions. Accessing these emerging knowledge flows is now possible across time and space. An added feature of OCs is that much of the interaction and exchange is archived and accessible for future participants. Thus new members have the ability to learn from prior interactions in history.

At a more fundamental level, the participants' engagement with language games necessitates tacit knowledge of past communication, not only personal identifiers or the lexical information on community-based terms. The underlying technology allows participants to map and imagine interactions, conversations, twists and turns, metaphors, jokes, and emotional expressions, and thus makes possible an abundant context for interpreting concepts and terms. Over time, past language games not only give participants a sense of community exchanges, but become available to participants as future opportunities for communication (see Astley and Zammuto 1992). Digital technologies also provide information about participants' unique engagement with a topic and the history of their interactions. The ease with which questions can be refined, refashioned, contextualized, and partial answers generated facilitates the sustained social engagement necessary for tacit-to-tacit collaboration to bear fruit.

Second, OC participants sustain the tacit-tacit flow by contextualizing their individual activities. Michael Polanyi, whose seminal work shaped much contemporary understanding of tacit knowledge (or "tacit knowing"), proposes: "There is (1) knowing a thing by attending to it, in the way we attend to an entity as a whole and (2) knowing a thing by relying on our awareness of it for the purpose of attending to an entity to which it contributes. The latter knowledge can be said to be tacit, so far as we cannot tell what the particulars are, on the awareness of which we rely for attending to the entity comprising them" (Polanyi 1962, p. 601). Polanyi (1962) distinguishes "knowing by attending to" from "knowing by relying on." Via this distinction, Polanyi (1962) argues that tacit knowing involves an interplay between attending to focal knowledge (the task focused on) and subsidiary knowledge (the complementary often background knowledge relied on in performing the focal task). In our setting, the dual nature of knowledge can be understood as follows: a participant may have focal knowledge of a task to which she attends, coupled with subsidiary knowledge of how to effectively and smoothly contribute to and rely on OC flows

for the purpose of performing that task. Participating in the OC debates via answering questions, seeking boundary conditions to existing knowledge, and jointly solving complex open problems enhances subsidiary knowledge available to the individual member.

A participant may not simultaneously attend both to the task at hand and the unfolding OC dynamics. Instead, when performing the task she will have a subsidiary awareness of the OC knowledge flows: how her knowledge production fits with the flow, how others in her imagined community may benefit from this work, who are the experts from whom to seek advice, and so on. While work online typically unfolds as a continuous arc of individual activity, it may be shaped by the underlying OC sociality, which over time instills a deep and tacit awareness of the context in which that activity unfolds. In other words, the task that I perform has value to me here and now, but equally important, when sharing back to the OC, I am contributing to the subsidiary knowing of other members.

Third, the OC's sociality may positively shape participants' subsidiary knowledge of standards of excellence (von Krogh et al. 2012). These implicit socially-validated standards provide a reference point for judging individual contributions. Participants subsidiarily rely on these standards to know what tasks or issues to focus and attend to. In this manner, standards of excellence underpin the tacit-tacit flows even though most OCs refrain from making such standards explicit to participants but still rely on them to function (MacIntyre 2007, von Krogh 2012, von Krogh et al. 2012). Thus to *be* an OC participant implies *providing* knowledge elements that meet or exceed these standards. Many observers of OCs have been puzzled by OCs' apparent capacity to create knowledge at the highest level of technical and scientific sophistication (Arazy et al. 2016, Lessl et al. 2011), and correspondingly ask why sophisticated, top notch participants contribute such knowledge for free (e.g., Lerner and Tirole 2002). To answer this question one may revert back to the individual motivation we discussed in the second section of this article. An alternative perspective originates in the tacit-tacit flows just described. OCs draw in a range of technical or scientific experts to a context of unconstrained interaction. By engaging in joint work, these experts extensively benefit from learning and building their reputation, but they also evolve yardsticks of technical or social performance towards which they may orient their individual efforts. Thus, the OC sociality facilitates the interplay between the participants' focal and subsidiary knowledge.

Toward a Research Agenda on OC

The main argument in this paper is that OCs offer participants opportunities to learn, share, and mix knowledge in ways that have similarities with face-to-face

communities of practice, but that they extend them via the unique sociality offered online. We go beyond the traditional view of human activity in OCs as being about the building of one's own social network, sharing opinions, identifying with causes/celebrities, digesting information feeds, or the sharing of likes/ dislikes. Instead, we suggest that an understudied but growing aspect of online life is the OC and its ability to sustain useful and value-generating knowledge flows. There are a number of implications of adopting our view of OCs as collective spaces of knowledge flows characterized by a continuous morphing and mutually constituted by platforms and participants. The OC's sociality facilitates the sharing of explicit knowledge, but more importantly, supports tacit-to-tacit flows among participants. These issues translate into a number of promising open research questions. They include: the constitution and stability of OCs, the flows between OCs, how to conceptualize the value of the knowledge they generate for entrepreneurship, OC governance and evolving norms, and perhaps most important, the OC as a locus of innovation.

The question of what constitutes an OC, its boundaries, and how to sustain it remains open. Because of the fluidity of participants' engagement, their ability to lurk or leave the community at will, to cycle between full engagement and neglect, and to take on self-defined roles, it remains difficult to understand how OCs operate. As spaces of knowledge creation, social tensions can be productive (Faraj et al. 2011) and attractive to those seeking practice focused learning and identity (von Krogh et al. 2012). Yet, given the importance of sociality as a driver for sustaining the OC and its output, we know little about the structure of interactions that is generative for knowledge creation. For example, recent work has recognized OCs as social fields where status, influence, positioning, and distinction matter a great deal (Levina and Arriaga 2014); yet, the impact of such a field structure on knowledge flows is unclear. Similarly, if OC social interactions are characterized by norms of direct and generalized reciprocity, at what level do they help or hinder knowledge creation (Faraj and Johnson 2011)? Finally, what are the implications of boundary permeability for OCs? We are still lacking theory and empirical evidence as to the optimal degree of boundary permeability and the impact it may have on OCs. If permeability is high, new participants and knowledge may flow easily when the community acts as an attractor. However, it makes it a challenge to retain members' attention and expertise at other times, putting the OC's sustenance at risk.

Beyond the healthy interest in knowledge creation within an OC, little research has addressed the considerable knowledge flows between OCs. For example, it has been documented that open source communities

outsource the maintenance of specific software modules to projects where these originated (Haefliger et al. 2008), and firms and other organizations increasingly find such open source outsourcing beneficial (Ågerfalk and Fitzgerald 2008). By outsourcing activities, the OC can focus its value creation on what its participants find meaningful and a good fit for their skills. However, outsourcing makes value creation increasingly entangled across communities, firms, and other organizations (Stewart et al. 2006). At the core of such entangled relations, explicit-explicit knowledge flows enable multiple OCs to conduct their work efficiently and incorporate technology and information created by other entities. Today there is limited understanding about the nature of such entangled flows, what factors inhibit or reinforce them, and how OCs absorb external knowledge by morphing participation and having dynamic boundaries. We stipulate such flows are extensive, and under many conditions shape, limit or boost knowledge creation and value creation. Thus, more research on inter-OC flows is warranted. For instance, it could be valuable to examine how the capacity to absorb knowledge relates to the past problem solving activities of OCs (Haas et al. 2015), and how digital technologies enable OCs to realize this capacity (Zahra and George 2002). It could also be useful to investigate the trust that potential users place in outsourcing communities, or even novel forms of trusting the insourced technology (see Lankton et al. 2016).

Our discussion of value creation in OCs has alluded to differences between the goals of regular members of OCs who may be motivated by intrinsic, extrinsic, and pro-social motives through involvement in the community, and the goals of other classes of participants. As seen on open source projects, OCs now attract participation from heterogeneous actors such as established firms or entrepreneurs. The question that needs to be explored is whether the activities of firms and entrepreneurs seeking to identify or monetize ideas are inconsistent with the goals of the OC and whether they hinder or strengthen knowledge processes. The early evidence indicates that OCs facilitate entrepreneurial value creation extensively and these may lead to positive feedback in terms of increased knowledge flows (see Haefliger et al. 2011, Hienerth and Lettl 2011). Participants who become entrepreneurs often draw on their off- and online communities to explore business ideas and models, gauge viability of prototypes, and seek practical advice from peers (Shah and Tripsas 2007; see also Autio et al. 2013). Entrepreneurs likely discover knowledge flows related to user needs and potential solutions expressed by the OC participants. Successful entrepreneurs may have better and deeper insights than their peers on how to turn these need-solution pairs into business opportunities (von Hippel and von Krogh 2016). Yet, what is the specific role of

explicit-tacit flows for developing such understanding and participants' decision to become entrepreneurs? How does the entrepreneur convert such OC-wide need-solution pair information into an opportunity for value creation?

The issue of governance or how activities are coordinated and controlled on OCs is another central question needing systematic scholarly attention. There is general agreement that the OCs constitute a form of collective organizing that is different from the traditional bureaucratic forms of organizing, and thus may require novel forms of governance (Markus 2007). At the core, the problem of managing interdependencies and coordinating effort is even more acute in a form of organizing where roles are minimally specified and formal authority over participants limited. Early research points to the emergence of a shared form of authority where expertise is a major criteria (Dahlander and O'Mahony 2011, O'Mahony and Ferraro 2007) or identifies shared leadership as the most effective way to form an authority structure (Johnson et al. 2015). Much can be learned from how communities-of-practice (CoP) are organized given their nature as organically organized arenas that weave knowledge creation with the social formation of a community, with membership, belonging, and identity. The self-organized quality of CoPs are what gives them meaning and importance and attempts to "over-organize" them are likely to weaken the knowledge flows that make them successful in the first place (Thompson 2005). As current studies point out, there are clear boundaries to what type and degree of interference are possible in OCs without disrupting the productive, spontaneous knowledge creation (see Shaikh and Vaast 2016).

In this article we have been chiefly concerned with the epistemic features of OCs. Yet, discussing standards of excellence in tacit-tacit flows, we also hinted to OCs as sites where norms and values evolve. Rather than construing knowledge flows and ethics as two separate research areas, it may be promising to integrate them more extensively in future work. We think it is quite likely that standards of excellence and other norms and values in the OCs dynamically interact with the communities' knowledge flows. After all, it was the high work ethic and technical standards embedded in the social practice of software development that brought about the free- and open source software movements (von Krogh et al. 2012). An important research program will be one that compares the evolving standards of excellence across OCs, explores how and why they differ, and in addition gauges the extent to which OCs can emulate or even exceed standards of excellence deeply held by members of traditional organizations.

As OCs evolve and morph, they open-endedly expand and embrace new groups/participants that come with supplementary value creation approaches (Barrett et al. 2016). Thus, an implication of our framing is to invite a rethink of where the locus of innovation resides. The importance of the firm and its boundary for knowledge production is based on the need to bring together appropriate expertise and to support tacit-to-tacit interactions that are crucial for innovation and value creation. As a stream of work has concluded, socialization and tacit knowledge flows between individual organizational members may even constitute the raison d'être of the firm as a dominant site of knowledge creation (Conner and Prahalad 1996, Felin and Hesterly 2007, Kogut and Zander 1992, Nonaka et al. 2000, Nonaka and von Krogh 2009). Recent developments of enrolling users and participants from outside firm boundaries indicate the promise of complementary and sometimes less firm centric approaches to problem solving and knowledge creation (e.g., Boudreau and Lakhani 2015, Felin and Zenger 2014, Franke et al. 2013, Haefliger et al. 2011, Jeppesen and Lakhani 2010, Lakhani et al. 2013, Puranam et al. 2014, Spaeth et al. 2015, von Hippel 2007, von Krogh and von Hippel 2006). Thus, a pressing open question that invites investigation is if and to what extent innovations that previously could only be generated within the confines of a firm are migrating to the online space. Consequently, the firm needs to make critical decisions on the extent of their involvement with OCs, and in particular what tacit and explicit knowledge they should share with the community (Lakhani et al. 2013). Those knowledge flows can involve the firm or can be fully outside their scope.

Conclusion

We have conjectured that OCs by enabling tacit-tacit knowledge flows offer a new form of organizing that is increasingly "complete" in terms of knowledge creation. In line with calls from scholars to theorize the impact of online space (e.g., DeSanctis and Monge 1999, Haefliger et al. 2011, Zammuto et al. 2007), we stipulate that this may even shift an increasing amount of innovation and other value creating activities, from the "physically" constrained space of traditional firms to the open digital space of OCs.

We suggest that research that goes beyond the application of a few select social psychological theories and the routine application of network analysis tools to explain complex online actions and organizing is needed. Consistent with recent advances in the science of networks, new ways of representing action, actors, artifacts, and outcomes are called for. Above all, new theorizing that crosses levels of analysis, does not blackbox technology, nor conflates OC activities

with aspects such as the use of social media tools warrants attention. Central to new modes of theorizing is a stronger, perhaps constitutive, role of technology in the very phenomenon under study. By taking stock of drivers for action, the emergent practices, and the evolving form of OC organizing, we hope to advance new views on change and adaptation of organizations, thereby giving OCs a central position in the discourse on the new online realities.

Acknowledgments

Appendix. Special Issue Acknowledgement

The *ISR* call for papers on Collaboration and Value Creation in Online Communities generated 72 submissions that underwent rigorous peer review. Following the usual review cycles, seven manuscripts were eventually selected for inclusion in the special issue. The papers presented on the following pages represent state of the art on theory and research related to the intricate and complex nature of online communities. The collection of papers pushes the scholarly boundaries and together represents a major step forward in our understanding of the online phenomena. The authors would like to thank the following 114 individuals for their extensive editorial and review work that went into the collective production of this special issue of *ISR*:

Acquisti, Alessandro
Alaimo, Cristina
Avital, Michel
Barrett, Michael
Bergenholtz, Carsten
Blanchard, Anita
Boons, Mark
Bunduchi, Raluca
Burtch, Gordon
Butler, Brian
Bygstad, Bendik
Collier, Benjamin
Conaldi, Guido
Constantinides, Panos
Crowston, Kevin
Cummings, Jonathon
da Cunha, Joao
Dabbish, Laura
Daniel, Sherae
Dellarocas, Chris
Espinosa, J. Alberto
Farzan, Rosta

Fauchart, Emmanuelle
Fayard, Anne-Laure
Frederiksen, Lars
Frost, Jeana
Frutiger, Michael
Fulk, Janet
Galliers, Robert
Gu, Bin
Guo, Hong
Haefliger, Stefan
Hanseth, Ole
Hayes, Niall
Henfridsson, Ola
Hou, Jinghui
Huysman, Marleen
Hwang, Elina
Jackson, Steven
Jain, Radhika
Jeppesen, Lars Bo
Johnson, Steven
Kallinikos, Jannis
Kane, Gerald
Kang, Keumseok
Kankanhalli, Atreyi
Kelly, Seamas
Kiesler, Sara
Kraut, Robert
Kudaravalli, Sri
Kuk, George
Kundisch, Dennis
Lang, Karl
Lee, Gwanhoo
Leimeister, Jan Marco
Leonardi, Paul
Leung, Ming
Levina, Natalia
Li, Shanling
Lin, Mingfeng
Liu, Peng
Lomi, Alessandro
Marabelli, Marco
Meng, Jingbo
Metiu, Anca
Monge, Peter
Nan, Ning
Nandhakumar, Joe
Neyland, Daniel
Nicolini, Davide
Oborn, Eivor
O'Mahony, Siobhan
Orlikowski, Wanda
Osterlund, Carsten
Pentland, Brian
Phelps, Corey
Pollock, Neil
Ramaprasad, Jui
Ransbotham, Sam
Ren, Yuqing
Resnick, Paul
Ribes, David
Rice, Ron

Robert, Lionel
Rullani, Francesco
Safadi, Hani
Scarbrough, Harry
Schlagwein, Daniel
Schultze, Ulrike
Schumaker, Robert
Scott, Susan
Shaikh, Maha
Singh, Param
Spaeth, Sebastian
Stein, Mari-Klara
Steinfield, Charles
Subramanyam, Ramanath
Sutanto, Juliana
Teigland, Robin
Thompson, Mark
Tubaro, Paola
Tuertscher, Philipp
Van Osch, Wietske
Verona, Gianmario
Volkoff, Olga
von Hippel, Eric
Wasko, Molly
Wellman, Barry
Welser, Ted
Yates, JoAnne
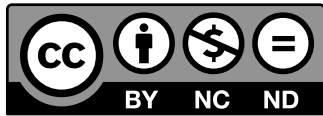Ye, Hua (Jonathan)
Yoo, Youngjin
Zhang, Chen
Zhu, Haiyi

References

Ågerfalk PJ, Fitzgerald B (2008) Outsourcing to an unknown workforce: Exploring opensourcing as a global sourcing strategy. *MIS Quart.* 32(2):385–409.

Alavi M, Leidner DE (2001) Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quart.* 25(1):107–136.

Almeida P, Phene A (2004) Subsidiaries and knowledge creation: The influence of the MNC and host country on innovation. *Strategic Management J.* 25(8–9):847–864.

Amit R, Zott C (2001) Value creation in e-business. *Strategic Management J.* 22(6–7):493–520.

Arazy O, Daxenberger J, Lifshitz-Assaf H, Nov O, Gurevych I (2016) Turbulent stability of emergent roles: The dualistic nature of self-organizing knowledge coproduction. *Inform. Systems Res.* Forthcoming.

Astley WG, Zammuto RF (1992) Organization science, managers, and language games. *Organ. Sci.* 3(4):443–460.

Autio E, Dahlander L, Frederiksen L (2013) Information exposure, opportunity evaluation, and entrepreneurial action: An investigation of an online user community. *Acad. Management J.* 56(5):1348–1371.

Barrett M, Oborn E, Orlikowski WJ (2016) Creating value in online communities: The sociomaterial configuring of strategy, platform, and stakeholder engagement. *Inform. Systems Res.* Forthcoming.

Bateman PJ, Gray PH, Butler BS (2011) Research note—The impact of community commitment on participation in online communities. *Inform. Systems Res.* 22(4):841–854.

Bauer J, Franke N, Tuertscher P (2016) Intellectual property norms in online communities: How user-organized intellectual property regulation supports innovation. *Inform. Systems Res.* Forthcoming.

Benkler Y (2006) *The Wealth of Networks: How Social Production Transforms Markets and Freedom* (Yale University Press, New Haven, CT).

Bhargave R, Mantonakis A, White K (2016) The cue-of-the-cloud effect: When reminders of online information availability increase purchase intentions and choice. *J. Marketing Res.* 52(6):699–711.

Blanchard AL, Markus ML (2004) The experienced "sense" of a virtual community. *DATA BASE Adv. Inform. Systems* 35(1):65–79.

Blohm I, Riedl C, Füller J, Leimeister JM (2016) Rate or trade? Identifying winning ideas in open idea sourcing. *Inform. Systems Res.* 27(1):27–48.

Bogers M, Afuah A, Bastian B (2010) Users as innovators: A review, critique, and future research directions. *J. Management* 36(4):857–875.

Boje DM, Oswick C, Ford JD (2004) Language and organization: The doing of discourse. *Acad. Management Rev.* 29(4):571–577.

Boland RJ, Tenkasi R (1995) Perspective making and perspective taking in communities of knowing. *Organ. Sci.* 6(4):350–372.

Bonaccorsi A, Giannangeli S, Rossi C (2006) Entry strategies under competing standards: Hybrid business models in the open source software industry. *Management Sci.* 52(7):1085–1098.

Boudreau KJ, Lakhani KR (2009) How to manage outside innovation. *MIT Sloan Management Rev.* 50(4):69–76.

Boudreau KJ, Lakhani KR (2015) "Open" disclosure of innovations, incentives and follow-on reuse: Theory on processes of cumulative innovation and a field experiment in computational biology. *Res. Policy* 44(1):4–19.

Bourdieu P (1977) *Outline of a Theory of Practice* (Cambridge University Press, Cambridge, UK).

Bowman C, Ambrosini V (2000) Value creation vs. value capture: Towards a coherent definition of value in strategy. *British J. Management* 11(1):1–15.

Brint S (2001) Gemeinschaft revisited: A critique and reconstruction of the community concept. *Sociol. Theory* 19(1):1–23.

Brown JS, Duguid P (1991) Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organ. Sci.* 2(1):40–57.

Browne GJ, Pitts MG, Wetherbe JC (2007) Cognitive stopping rules for terminating information search in online tasks. *MIS Quart.* 31(1):89–104.

Butler B, Sproull L, Kiesler S, Kraut R (2007) Community effort in online groups: Who does the work and why? Weisband SP, ed. *Leadership at a Distance: Research in Technologically-Supported Work* (Lawrence Erlbaum, Mahwah, NJ), 171–193.

Chen Y, Harper FM, Konstan J, Li SX (2010) Social comparisons and contributions to online communities: A field experiment on MovieLens. *Amer. Econom. Rev.* 100(4):1358–1398.

Chiu C-M, Hsu M-H, Wang ET (2006) Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories. *Decision Support Systems* 42(3):1872–1888.

Conner KR, Prahalad CK (1996) A resource-based theory of the firm: Knowledge vs. opportunism. *Organ. Sci.* 7(5):477–501.

Cummings JN, Kraut R (2002) Domesticating computers and the Internet. *Inform. Soc.* 18(3):221–231.

Dahlander L, Frederiksen L (2012) The core and cosmopolitans: A relational view of innovation in user communities. *Organ. Sci.* 23(4):988–1007.

Dahlander L, O'Mahony S (2011) Progressing to the center: Coordinating project work. *Organ. Sci.* 22(4):961–979.

de Laet M, Mol A (2000) The Zimbabwe bush pump: Mechanics of a fluid technology. *Soc. Stud. Sci.* 30(2):225–263.

Dejean S, Jullien N (2015) Big from the beginning: Assessing online contributors' behavior by their first contribution. *Res. Policy* 44(6):1226–1239.

DeSanctis G, Monge P (1999) Introduction to the special issue: Communication processes for virtual organizations. *Organ. Sci.* 10(6):693–703.

Evans DS, Hagiu A, Schmalensee R (2006) *Invisible Engines: How Software Platforms Drive Innovation and Transform Industries* (MIT Press, Cambridge, MA).

Faraj S, Johnson SL (2011) Network exchange patterns in online communities. *Organ. Sci.* 22(6):1464–1480.

Faraj S, Jarvenpaa SL, Majchrzak A (2011) Knowledge collaboration in online communities. *Organ. Sci.* 22(5):1224–1239.

Fayard A-L, DeSanctis G (2010) Enacting language games: The development of a sense of "we-ness" in online forums. *Inform. Systems J.* 20(4):383–416.

Felin T, Hesterly W (2007) The knowledge-based view, nested heterogeneity, and new value creation: Philosophical considerations on the locus of knowledge. *Acad. Management Rev.* 32(1):195–218.

Felin T, Zenger TR (2014) Closed or open innovation? Problem solving and the governance choice. *Res. Policy* 43(5):914–925.

Fjeldstad ØD, Snow CC, Miles RE, Lettl C (2012) The architecture of collaboration. *Strategic Management J.* 33(6):734–750.

Fleming L (2001) Recombinant uncertainty in technological search. *Management Sci.* 47(1):117–132.

Forman C, Ghose A, Wiesenfeld B (2008) Examining the relationship between reviews and sales: The role of reviewer identity disclosure in electronic markets. *Inform. Systems* 19(3):291–313.

Franke N, Keinz P, Klausberger K (2013) "Does this sound like a fair deal?": Antecedents and consequences of fairness expectations in the individual's decision to participate in firm innovation. *Organ. Sci.* 24(5):1495–1516.

Fulk J, DeSanctis G (1995) Electronic communication and changing organizational forms. *Organ. Sci.* 6(4):337–349.

Gawer A (2009) *Platforms, Markets and Innovation* (Edward Elgar Publishing, Cheltenham, UK).

Goes PO, Lin M, Yeung CA (2014) "Popularity effect" in user-generated contents: Evidence from online product reviews. *Inform. Systems Res.* 25(2):222–238.

Grene M (1977) Tacit knowing: Grounds for a revolution in philosophy. *J. British Soc. Phenomenology* 8(3):164–171.

Gruber M, Harhoff D, Hoisl K (2013) Knowledge recombination across technological boundaries: scientists vs. engineers. *Management Sci.* 59(4):837–851.

Haas MR, Criscuolo P, George G (2015) Which problems to solve? Attention allocation and online knowledge sharing in organizations. *Acad. Management J.* 58(3):680–711.

Haefliger S, von Krogh G, Spaeth S (2008) Code reuse in open source software. *Management Sci.* 54(1):180–193.

Haefliger S, Monteiro E, Foray D, von Krogh G (2011) Social software and strategy. *Long Range Planning* 44(5–6):297–316.

Hann I, Koh B, Niculescu M (2016) The double-edged sword of backward compatibility: The adoption of multigenerational platforms in the presence of intergenerational services. *Inform. Systems Res.* 27(1):112–130.

Hann IH, Roberts JA, Slaughter SA (2013) All are not equal: An examination of the economic returns to different forms of participation in open source software communities. *Inform. Systems Res.* 24(3):520–538.

Harhoff D, Lakhani KR, eds. (2016) *Revolutionizing Innovation: Users, Communities, and Open Innovation* (MIT Press, Cambridge, MA).

Hertel G, Niedner S, Herrmann S (2003) Motivation of software developers in open source projects: An Internet-based survey of contributors to the Linux kernel. *Res. Policy* 32(7):1159–1177.

Hienerth C, Lettl C (2011) Exploring how peer communities enable lead user innovations to become standard equipment in the industry: Community pull effects. *J. Product Innovation Management* 28(s1):175–195.

Hirsch E, Silverstone R, eds. (2003) *Consuming Technologies: Media and Information in Domestic Spaces* (Routledge, New York).

Holmström H, Henfridsson O (2006) Improving packaged software through online community knowledge. *Scandinavian J. Inform. Systems* 18(1):3–36.

Jarvenpaa S, Leidner D (1998) An information company in Mexico: Extending the resource-based view of the firm to a developing country context. *Inform. Systems Res.* 9(4):342–361.

Jeppesen LB, Lakhani KR (2010) Marginality and problem-solving effectiveness in broadcast search. *Organ. Sci.* 21(5):1016–1033.

Johnson SL, Safadi H, Faraj S (2015) The emergence of online community leadership. *Inform. Systems Res.* 26(1):165–187.

Kankanhalli A, Tan BCY, Wei K (2005) Contributing knowledge to electronic knowledge repositories: An empirical investigation. *MIS Quart.* 29(1):113–143.

Kogut B, Zander U (1992) Knowledge of the firm, combinative capabilities, and the replication of technology. *Organ. Sci.* 3(3):383–397.

Kohler T, Fueller J, Matzler K, Stieger D (2011) Co-creation in virtual worlds: The design of the user experience. *MIS Quart.* 35(3):773–788.

Kraut RE, Resnick P (2012) *Building Successful Online Communities: Evidence-Based Social Design* (MIT Press, Cambridge, MA).

Lakhani KR (2016) Managing communities and contests to innovate with crowds. *Revolutionizing Innovation: Users, Communities, and Open Innovation* (MIT Press, Cambridge, MA), 109–134.

Lakhani KR, von Hippel E (2003) How open source software works: "Free" user-to-user assistance. *Res. Policy* 32(6):923–943.

Lakhani K, Wolf RG (2005) Why hackers do what they do: Understanding motivation and effort in free/open source software projects. Feller J, Fitzgerald B, Hissam S, Lakhani K, eds. *Perspectives on Free and Open Source Software* (MIT Press, Cambridge, MA), 3–22.

Lakhani KR, Lifshitz-Assaf H, Tushman ML (2013) Open innovation and organizational boundaries: The impact of task decomposition and knowledge distribution on the locus of innovation. Grandori A, ed. *Handbook of Economic Organization: Integrating Economic and Organization Theory* (Edward Elgar Publishing, Cheltenham, UK), 355–382.

Lankton N, McKnight D, Wright R, Thatcher JB (2016) Research note—Using expectation disconfirmation theory and polynomial modeling to understand trust in technology. *Inform. Systems Res.* 27(1):197–213.

Law J (2002) Objects and spaces. *Theory, Culture Soc.* 19(5/6):91–105.

Lepak DP, Smith KG, Taylor MS (2007) Value creation and value capture: A multilevel perspective. *Acad. Management Rev.* 32(1):180–194.

Lerner J, Tirole J (2002) Some simple economics of open source. *J. Indust. Econom.* 50(2):197–234.

Lessl M, Bryans JS, Richards D, Asadullah K (2011) Crowd sourcing in drug discovery. *Nature Rev. Drug Discovery* 10(4):241–242.

Levina N, Arriaga M (2014) Distinction and status production on user-generated content platforms: Using Bourdieu's theory of cultural production to understand social dynamics in online fields. *Inform. Systems Res.* 25(3):468–488.

Lindberg A, Berente N, Gaskin J, Lyytinen K (2016) Coordinating interdependencies in online communities: A study of an open source software project. *Inform. Systems Res.* Forthcoming.

Lu Y, Jerath K, Singh P (2013) The emergence of opinion leaders in a networked online community: A dyadic model with time dynamics and a heuristic for fast estimation. *Management Sci.* 59(8):1783–1799.

Lyytinen K, Yoo Y, Boland RJ (2016) Digital product innovation within four classes of innovation networks. *Inform. Systems J.* 26(1):47–75.

Ma M, Agarwal R (2007) Through a glass darkly: Information technology design, identity verification, and knowledge contribution in online communities. *Inform. Systems Res.* 18(1):42–67.

MacIntyre A (2007) *After Virtue*, Third ed. (Bloomsbury, London).

Majchrzak A, Malhotra A (2016) Effect of knowledge-sharing trajectories on innovative outcomes in temporary online crowds. *Inform. Systems Res.* Forthcoming.

Majchrzak A, More PHB, Faraj S (2012) Transcending knowledge differences in cross-functional teams. *Organ. Sci.* 23(4):951–970.

Majchrzak A, Wagner C, Yates D (2013) The impact of shaping on knowledge reuse for organizational improvement with wikis. *MIS Quart.* 37(2):455–469.

Markus M (2007) The governance of free/open source software projects: Monolithic, multidimensional, or configurational? *J. Management Governance* 11(2):151–163.

Markus ML, Manville B, Agres CE (2000) What makes a virtual organization work? *MIT Sloan Management Rev.* 42(1):13–26.

Minar D, Greer S (1969) *The Concept of Community: Readings with Interpretations* (Aldine, Chicago).

Monteiro E (1998) Living with technology. *Scandinavian J. Inform. Systems* 10(1&2):249–254.

Nambisan S, Baron RA (2010) Different roles, different strokes: Organizing virtual customer environments to promote two types of customer contributions. *Organ. Sci.* 21(5):554–572.

Nelson RR, Winter SG (1982) *An Evolutionary Theory of Economic Change* (Harvard University Press, Cambridge, MA).

Nonaka I (1994) A dynamic theory of organizational knowledge creation. *Organ. Sci.* 5(1):14–37.

Nonaka I, Konno N (1998) The concept of "Ba": Building a foundation for knowledge creation. *California Management Rev.* 40(3):40–54.

Nonaka I, von Krogh G (2009) Tacit knowledge and knowledge conversion: Controversy and advancement in organizational knowledge creation theory. *Organ. Sci.* 20(3):635–652.

Nonaka I, Toyama R, Konno N (2000) SECI, Ba and leadership: A unified model of dynamic knowledge creation. *Long Range Planning* 33(1):5–34.

Olson JS, Teasley S, Covi L, Olson G (2002) The (currently) unique advantages of collocated work. Hinds P, Kiesler S, eds. *Distributed Work* (MIT Press, Cambridge, MA), 113–135.

O'Mahony S, Ferraro F (2007) The emergence of governance in an open source community. *Acad. Management J.* 50(5):1079–1106.

O'Mahony S, Lakhani KR (2011) Organizations in the shadow of communities. Marquis C, Lounsbury M, Greenwood R, eds. *Research in the Sociology of Organizations: Communities and Organizations*, Vol. 33 (Emerald Group Publishing, Bingley, UK), 3–36.

Osterloh M, Frey BS (2000) Motivation, knowledge transfer, and organizational forms. *Organ. Sci.* 11(5):538–550.

Osterloh M, Rota S (2007) Open source software development–just another case of collective invention? *Res. Policy* 36(2):157–171.

Parker GG, van Alstyne MW (2005) Two-sided network effects: A theory of information product design. *Management Sci.* 51(10):1494–1504.

Phang CW, Kankanhalli A, Tan BCY (2015) What motivates contributors vs. lurkers? An investigation of online feedback forums. *Inform. Systems Res.* 26(4):773–792.

Polanyi M (1962) Tacit knowing: Its bearing on some problems of philosophy. *Rev. Modern Phys.* 34(4):601–616.

Puranam P, Alexy O, Reitzig M (2014) What's "new" about new forms of organizing? *Acad. Management Rev.* 39(2):162–180.

Ray S, Kim SS, Morris JG (2014) The central role of engagement in online communities. *Inform. Systems Res.* 25(3):528–546.

Ren Y, Kraut R, Kiesler S (2007) Applying common identity and bond theory to design of online communities. *Organ. Stud.* 28(3):377–408.

Ren Y, Harper FM, Drenner S, Terveen L, Kiesler S, Riedl J, Kraut RE (2012) Building member attachment in online communities: Applying theories of group identity and interpersonal bonds. *MIS Quart.* 36(3):841–864.

Ross DAR (2007) Backstage with the knowledge boys and girls: Goffman and distributed agency in an organic online community. *Organ. Stud.* 28(3):307–325.

Shah S, Tripsas M (2007) The accidental entrepreneur: The emergent and collective process of user entrepreneurship. *Strategic Entrepreneurship J.* 1(1–2):123–140.

Shah SK (2006) Motivation, governance, and the viability of hybrid forms in open source software development. *Management Sci.* 52(7):1000–1014.

Shaikh M, Vaast E (2016) Folding and unfolding: Balancing openness and transparency in open source communities. *Inform. Systems Res.* Forthcoming.

Simon HA (1997) The future of information systems. *Ann. Oper. Res.* 71(3):3–14.

Singh PV, Phelps C (2013) Networks, social influence, and the choice among competing innovations: Insights from open source software licenses. *Inform. Systems Res.* 24(3):539–560.

Spaeth S, von Krogh G, He F (2015) Perceived firm attributes and intrinsic motivation in sponsored open source software projects. *Inform. Systems Res.* 26(1):224–237.

Sproull L, Arriaga M (2007) Online communities. Bidgoli H, ed. *Handbook of Computer Networks: Distributed Networks, Network Planning, Control, Management, and New Trends and Applications*, Vol. 3 (John Wiley & Sons, New York), 898–914.

Stanko MA (2016) Toward a theory of remixing in online innovation communities. *Inform. Systems Res.* Forthcoming.

Stewart K, Ammeter A, Maruping LM (2006) Impacts of license choice and organizational sponsorship on user interest and development activity in open source software projects. *Inform. Systems Res.* 17(2):126–144.

Stewart KJ, Gosain S (2006) The impact of ideology on effectiveness in open source software development teams. *MIS Quart.* 30(2):291–314.

Sundararajan A, Provost F, Oestreicher-Singer G, Aral S (2013) Research commentary–Information in digital, economic, and social networks. *Inform. Systems Res.* 24(4):883–905.

Tassi P (2012) Facebook didn't kill Digg, Reddit did. *Forbes* (July 13) http://www.forbes.com/sites/insertcoin/2012/07/13/facebook-didnt-kill-digg-reddit-did/#5b1c22c434aa.

Thompson M (2005) Structural and epistemic parameters in communities of practice. *Organ. Sci.* 16(2):151–164.

Tiwana A, Konsynski B, Bush AA (2010) Research commentary–Platform evolution: Coevolution of platform architecture, governance, and environmental dynamics. *Inform. Systems Res.* 21(4):675–687.

Treem JW, Leonardi PM (2012) Social media use in organizations. *Comm. Yearbook* 36:143–189.

Tsoukas H (2009) A dialogical approach to the creation of new knowledge in organizations. *Organ. Sci.* 20(6):941–957.

Vaccaro A, Veloso F, Brusoni S (2009) The impact of virtual technologies on knowledge-based processes: An empirical study. *Res. Policy* 38(8):1278–1287.

von Hippel E (2007) Horizontal innovation networks—By and for users. *Indust. Corporate Change* 16(2):293–315.

von Hippel E, von Krogh G (2016) Crossroads—Identifying viable "need–solution pairs": Problem solving without problem formulation. *Organ. Sci.* 27(1):207–221.

von Krogh G (2012) How does social software change knowledge management? Toward a strategic research agenda. *J. Strategic Inform. Systems* 21(2):154–164.

von Krogh G, von Hippel E (2006) The promise of research on open source software. *Management Sci.* 52(7):975–983.

von Krogh G, Spaeth S, Lakhani KR (2003) Community, joining, and specialization in open source software innovation: A case study. *Res. Policy* 32(7):1217–1241.

von Krogh G, Haefliger S, Spaeth S, Wallin M (2012) Carrots and rainbows: Motivation and social practice in open source software development. *MIS Quart.* 36(2):649–676.

Walther JB (2007) Selective self-presentation in computer-mediated communication: Hyperpersonal dimensions of technology, language, and cognition. *Comput. Human Behav.* 23(5):2538–2557.

Wasko MM, Faraj S (2005) Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quart.* 29(1):35–57.

Wen W, Forman C, Graham SJH (2013) The impact of intellectual property rights enforcement on open source software project success. *Inform. Systems Res.* 24(4):1131–1146.

Wenger E (1998) *Communities of Practice: Learning, Meaning, and Identity* (Cambridge University Press, Cambridge, UK).

Wittgenstein L (1953) *Philosophical Investigations* (Basil Blackwell, Oxford, UK).

Yan L, Tan Y (2014) Feeling blue? Go online: An empirical study of social support among patients. *Inform. Systems Res.* 25(4):690–709.

Yoo Y, Boland RJ, Lyytinen K, Majchrzak A (2012) Organizing for innovation in the digitized world. *Organ. Sci.* 23(5):1398–1408.

Zahra SA, George G (2002) Absorptive capacity: A review, and extension. *Acad. Management Rev.* 27(2):185–203.

Zammuto RF, Griffith TL, Majchrzak A, Dougherty DJ, Faraj S (2007) Information technology and the changing fabric of organization. *Organ. Sci.* 18(5):749–762.

Zhang C, Hahn J, De P (2013) Continued participation in online innovation communities: Does community response matter equally for everyone? *Inform. Systems Res.* 24(4):1112–1130.

Zittrain JL (2008) *The Future of the Internet and How to Stop It* (Yale University Press, New Haven, CT).