Why Do User Communities Matter for Strategy?

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Abstract

User communities represent a unique organizing structure for the exchange of ideas and knowledge. They are organizations composed primarily of users working collaboratively, voluntarily, and with minimal oversight to freely and openly develop and exchange knowledge around a common artifact. The prevalence of user communities appears to be on the rise, as evidenced by communities across a variety of fields ranging from software to Legos to sports equipment. In this essay, we discuss how firms can benefit from working with user communities––that is, we discuss the opportunities for firms to leverage user communities as a source of open innovation. We theorize the conditions under which user communities will emerge and function, and discuss the benefits that user communities can provide and the challenges they can create for firms, thereby illustrating the relevance and import of user communities to firms and the strategic management literature.

Introduction

Projects undertaken by user communities have achieved remarkable success. User communities provide participants with the social context and resources to create useful and publicly available designs for physical products and copies of digital products that have inspired, extended, and even displaced commercially produced products (Allen 1983; Benkler 2002; von Hippel and von Krogh 2003). User communities can also play a role in spurring and supporting the creation of new firms (Baldwin et al. 2006; Shah and Tripsas 2007). User communities are distinct from other models of organizing for innovation—such as firms and academic labs—in that they rely on the aggregated efforts of a community of volunteer participants rather than on paid managers and employees.

User communities are not a new phenomenon; user communities dating back to the early 1800s have been documented amongst consumers of automobiles and corporate users of industrial equipment (Allen 1983; Franz 1999; Nuvolari 2004; Nuvolari 2005). However, the advent of communication technologies like the Internet have enabled people to communicate more quickly and less expensively, decreasing the costs of participation and possibly increasing the size and number of communities. Open source software development is a prominent and frequently studied example of the community-based model, but it is far from the only one. User communities have been influential in a diverse array of fields including sports equipment (Baldwin et al. 2006; Franke and Shah 2003; Lüthje et al. 2005), astronomy (Ferris 2002), personal computers (Freiberger and Swaine 2000), video games (Jeppesen and Frederiksen 2006), automobiles (Lucsko 2008), and probe microscopes (Mody 2011).

To date, the study of user communities has largely been the domain of scholars in technology and innovation management (e.g., Franke and Shah 2003; von Hippel and von Krogh 2003), organization theory (e.g., Dahlander and Frederiksen 2012; Felin and Zenger 2014; O'Mahony and Ferraro 2007; Puranam et al. 2014), the history and sociology of science (*e.g.,* Mody 2011), law (Benkler 2006; Frischmann et al. 2014; Lessig 2006), and, occasionally, marketing (e.g., Muñiz and Schau 2005) and anthropology (Coleman 2012). These scholars have investigated issues central to the functioning of user communities, such as the motives and actions of participants (e.g., Franke and Shah 2003; Hann et al. 2006; Hertel et al. 2003; Jeppesen and Frederiksen 2006), the governance practices that shape interaction patterns amongst participants

(e.g., O'Mahony and Ferraro 2007; Shah 2006), and the role communities play in supporting the creation of entrepreneurial ventures (e.g., Baldwin et al. 2006; Mody 2011; Shah and Tripsas 2007). We build on these findings to present what is known about user communities and how they function, as well as synthesize these findings to build a working definition of user communities and suggest conditions under which user communities will operate.

User communities can also contribute to or detract from firms' strategic positions. For example, user communities can and do serve as a source of ideas to fuel the open innovation process: the ideas and designs created within user communities can both inspire and compete with commercial products (Antorini et al. 2012; Valloppillil 1998); and firms regularly work within user communities and sometimes even seek to create and support communities around their products (e.g., Allen 1983; Dahlander and Wallin 2006; Henkel 2006). Yet, only recently have scholars begun to investigate issues of strategy in the context of user communities, and, as a result, a number of key questions relevant to the field of strategic management remain underexplored: for example, how can firms work with user communities to create and capture value? How does the presence of a user community(ies) alter competition amongst firms? Our purpose in this essay is to investigate the practical implications of embracing user communities for both firms and strategic management scholars.

From a theoretical standpoint, the open innovation literature—at the intersection of the strategic management and innovation literatures—provides a conduit connecting the study of strategic management to the study of user communities. The conceptualization of open innovation has recently been updated to be inclusive of non-firm actors (Chesbrough and Bogers 2014), which is critical as additional actors—such as user communities, independent inventors (Dahlander and Piezunka 2014; Hargadon and Yellowlees 2001), academic scientists and universities (Bercovitz and Feldman 2008; Merton 1973; Murray 2009), foundations (Feldman and Graddy-Reed 2014; Murray 2013), and standalone research institutes—contribute to innovation and the technical and social change that innovation ignites.

We begin by providing a working definition of user communities. We then review what is known about how user communities function and theorize a set of boundary conditions for when user communities will successfully function. We then turn to better understanding the relationships between user communities and firms, detailing the various ways in which firms have benefitted from working with user communities (*i.e.,* have successfully harnessed user communities to create

value). We conclude by suggesting a set of open questions investigating the implications of user communities for firms. Strategic management scholars possess the methodological tools and theoretical perspectives to improve our understanding of user communities, and user communities, in turn, have much to teach scholars about the limits and nuances of existing theory, precisely because they represent an alternative means for achieving some central and complex functions of the firm, *e.g.,* innovation creation, reproduction, diffusion, and more.

What Are User Communities?[1]

Historically, firms, independent inventors, and research institutions have been considered the primary engines of innovative activity, value creation, and industrial progress. In theory, the research and development efforts of most firms and independent inventors are based on a proprietary benefit model: exclusive property rights provide the basis for capturing value from innovative efforts. Firms and independent inventors strive to innovate in the hopes of realizing profits from products protected by patents, copyrights, and/or trade secrets. In contrast, the research and development activities of universities and research institutions are based on an academic model. Publication, status, and prestige are the rewards for innovative activity and full-time, professionally trained and compensated researchers direct their own efforts toward these goals, often under the aegis of government funding agencies, such as the National Science Foundation and National Institutes of Health.

Yet, another model—the "community-based" model—exists. In contrast to the proprietary and academic models, the community-based model relies neither on exclusive property rights nor hierarchical control. User communities represent a fundamentally different organizational model (Benkler 2002; Raymond 1999)—one that has been referred to as collective invention (Allen 1983), private-collective innovation (von Hippel and von Krogh 2003), and community-based innovation (Franke and Shah 2003; Lee and Cole 2003). User communities provide a forum for

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[1] A rich literature exists around the process of user innovation, which includes innovation by individual users, firms who are users, and user communities. Here we focus on issues related to *user communities* and firms, while acknowledging that more work linking user innovation in all its forms to firm strategy is necessary. We believe that a focus on user communities is warranted as user communities provide a forum in which many users (and firms) can interact, and thus provide a means of accessing multiple users and their insights. Note also that the importance of user innovation has been well documented across industries e.g., von Hippel (1988) and data on user innovation across populations and countries will likely be available soon (in 2018, the OECD began measuring "household sector innovation", a proxy for user innovation. de Jong 2016; Gault 2018).

users to aggregate and interact, generating and diffusing numerous innovations that we have come to use on a daily basis.

User communities have been around for hundreds of years. In the middle ages, craftsmen of various types would form guilds that were, at least in part, user communities dedicated to helping novice users of a particular product (a carpenter's hammer, a mason's chisel, a blacksmith's anvil, etc.) learn how to develop their skills to become master craftsmen. The history of the auto industry is filled with users, some of whom formed robust user communities and continue to do so (Franz 1999; Lucsko 2008). In the digital world, user groups have been a critical part of the ecosystem that has allowed digital technologies to flourish from the very beginning. For example, in 1955, a group of IBM mainframe users formed SHARE, a community for users of some of the earliest commercial computers to communicate their experiences, answer questions, and share code modifications they made to the operating system (which was one of the first examples of open source software) (SHARE 2019). Today, there are numerous user communities that support a variety of aspects of IT, including both hardware and software. Beyond digital technologies themselves, the decrease in communication costs enabled by technological advances, especially the Internet, has allowed physical goods with dedicated users to come together to share design tweaks and offer each other support (Altman et al. 2015).

Although a number of studies have investigated user communities from various perspectives, user communities have, to our knowledge, yet to be precisely defined. Therefore, we provide a working definition that takes key characteristics of user communities—knowledge development and exchange, participation, and control—into account: user communities are organizations composed primarily of users working collaboratively, voluntarily, and with minimal oversight to freely and openly develop and exchange knowledge in an area of common interest around an artifact. The artifact may be a design, physical object, product, good, or service.

Knowledge Development & Exchange. We characterize the general purpose of user communities as knowledge development and exchange. Most studies conducted to date focus on knowledge exchange that results in innovation or artifact development, but user communities also contribute to other ends, such as creating identity, excitement, and even brands around artifacts and supporting entrepreneurship through the commercialization of artifacts developed by participants. The free and open exchange of information in user communities is supported by transparency and freedom. Freedom in this context refers to the freedom to use and alter the artifact

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as desired for individual (and sometimes commercial) use, not necessarily free of cost (although often times it is also free of cost).[2] This is achieved through specific, subversive licensing practices. Transparency refers to the practice that all participants in the community can access shared information, request information from others, and identify the source of that information. To achieve this end, communities use various communication technologies, ranging from newsletters and magazines to searchable mailing lists and repositories.

Participation. User communities are composed largely of users—enthusiasts, tinkerers, amateurs, everyday people, and even firms that derive benefit from an artifact or service by *using* it (von Hippel 1988). Participants work collaboratively by sharing knowledge, information, and occasionally resources with other participants (Franke and Shah 2003).[3] In addition, participants work voluntarily.[4] Voluntary participation encompasses three dimensions: no remuneration from the community, self-chosen work, and relatively unrestricted entry (and exit) into the community. Participants generally do not receive remuneration or other benefits from the community as a direct result of their work. Participants identify and choose the work they will undertake: the community does not assign tasks to participants, rather participants choose whether or not to participate and how to participate.[5] And, the majority of communities allow anyone who wants to participate (or observe) to do so, and hence we often witness participants freely flowing into and out of the community.

Control & Governance. Governance structures observed to date appear to be aimed at establishing a context in which individuals who want to participate can do so and maintaining some control over the quality of shared resources (often designs) while keeping organizational costs low.[6] Communication amongst participants is critical as it is only through communication

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[2] This concept has been pithily captured by free software advocate Richard Stallman in the phrase "free as in free speech, not free beer" (Lessig 2006; Stallman 2001).

[3] We note that collaboration does not mean *always* working within a group: much problem identification, trial-and-error problem solving, and prototyping also occurs as an individual works independently on finding a solution to his or her particular need and then communicates with others in the group.

[4] On occasion, a firm may pay an employee to participate. This is discussed later as an opportunity for additional research.

[5] Participation may take a variety of forms: ranging from asking a technical support question (Huang et al. 2016) to offering help for menial tasks within the community in an effort to learn more deeply (Lakhani and Hippel 2003) to integrating ideas and innovations contributed by others into the artifact in a modular and effective manner (Shah 2006).

[6] Social identity plays a critical role in the continued success of user communities. If at least some members of the community do not feel a strong tie to the community, such that it becomes an important part of their identity, the ability of the community to grow and flourish may be diminished (Bagozzi and Dholakia 2006). This sense of identity becomes particularly important as a community changes over time (Brandtzæg and Heim 2008), as firms

that knowledge can be shared and innovations developed. Communities often maintain a short set of rules or norms of expected behavior aimed at establishing basic standards regarding how to participate and how participants interact with one another.[7] With respect to shared designs, many communities have "master designs" (referred to as source code in the open source context) which participants can use freely and which, if assembled correctly, will function. Maintaining the *accessibility* of these designs to those who want to use them is a key goal of communities; this is often done through subversive "copyleft" licensing systems, which are sometimes formalized (Coleman 2012; Lessig 1999; Stallman 2001). Maintaining the *integrity* of master designs, particularly in light of continuing development, is also critical, particularly for digital products: although additional or newer features and functionality are readily shared within the community, they are not integrated into the master design until vetted. Vetting may involve testing and/or briefly assessing whether the addition is useful to multiple users by trusted participants with the authority and technical ability to integrate the feature into the master design. In some communities, a subset of participants are elected or appointed to the position of being able to alter the master design (*e.g.,* administrators in Wikipedia and committers or maintainers in open source software projects. User communities tend to have fairly flat organizational structures. Even Linux, a community with a large number of participants designing a complex artifact, has only two types of participants: maintainers and everyone else[8]). Finally, user communities generally do not have paid staff, organizers, or managers to take on organizational tasks, so the very design of the community as an organizing structure keeps organizational costs relatively low.[9]

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exert more control over the community (Johri et al. 2011), or as a firm (or other external organization) begins to engage more with external actors (Lifshitz-Assaf 2018).

[7] For example, open source communities often suggest that new users search the list servs before asking questions, so as not to ask repetitive questions that have been answered and would both overtax those with knowledge and likely not receive a response; some communities maintain dual communication channels—one for new users asking questions and one for engaging in actual development work; some, but not all, communities, have guidelines suggesting mutual respect. Nearly all communities welcome new users; while we have rarely seen the reason for this stated within a community, it appears to be understood that new users bring in new problems to solve and new knowledge, thereby providing the community with both problem-related information and solution-related information (Rullani and Haefliger 2013).

[8] Although there are technically only two roles, in some communities there is some hierarchy amongst maintainers in that some maintainers have approval authority over larger sections of the code base.

[9] There may be some exceptions to this, particularly when firms organize user communities and pay an individual or staff to take care of some functions. Additionally, when some user communities become very large, like Linux and Apache, they require a formal organization with paid employees to add structure to the community (e.g., The Linux Foundation and The Apache Software Foundation). However, the vast majority of contributors actually writing code are users that are not paid by the organization.

Differentiating User Communities from Other Forms of Organizing

A variety of unique organizational forms around knowledge exchange and innovation exist; not all, however, are user communities. By our definition, open source communities would be representative of user communities. Wikipedia would also be considered a user community. An online group of music pirates, however, would not be an example of a user community because, although they seek to diffuse an artifact (music), they do not create it. A volunteer organization, like the Red Cross, would also not be an example of a user community as its goals transcend knowledge exchange, participation is selective, and control and governance structures are more complex.

User communities are also distinct from similar concepts like crowdsourcing and multi-sided platforms (MSPs). Although all three are enabled by technological changes and make firm boundaries more porous (Altman et al. 2019), crowdsourcing is focused on seeking solutions to a problem from individuals outside the boundaries of the organization (not just users), and, in general, participants do not interact with one another or share information (exceptions exist, such as the Netflix Progress Prize where solution information was shared; however, conversation amongst competitors was not encouraged and presumably relatively limited). In contrast, in a user community, the focus is on sharing ideas and/or sharing the experience of doing something together. MSPs are focused on bringing two (or more) distinct groups, frequently a producer or advertiser and some sort of customer or user, together on the platform. Therefore, while some crowdsourcing efforts may take advantage of a user community, and some user communities are part of a platform, the three are distinct concepts that can sometimes overlap in certain contexts.

Understanding the Inner Workings of User Communities

We delve deeper into two characteristics of user communities here that have puzzled scholars precisely due to their distinctiveness from other modes of organizing: the motivation of participants and control and governance structures used to coordinate actions—or, at least, bring together ideas.

Participant Motivation

Motivation provides the reasons for people's actions, willingness, and goals. Scholars, noting that talented participants engage in significant work within user communities without pay have investigated participant motives in a variety of communities. Studies find that participants

often possess multiple motives; that motives differ amongst participants; that an individual's motives for developing knowledge and for contributing it to the community will often differ; and that motives can evolve over time (Lakhani and Wolf 2005; Shah 2006).[10] A wide variety of intrinsic and extrinsic motivations have been proposed and investigated. Below, we review motives that have received empirical support and discuss what is known about the evolution of motives. In addition, we describe what is known about participation paid for by third parties. Intrinsic motivation reflects a desire to seek out new things and new challenges, to analyze one's capacity, to observe and to gain knowledge (Ryan and Deci 2000). It includes benefits gained directly from engaging in the task itself.

Beginning with self-focused intrinsic motives, participating may allow an individual a means for fulfilling a need for creative, challenging, and enjoyable work (Brabham 2010; Shah 2006) or self-efficacy (Hsu et al. 2007). Individuals may also participate in a user community simply because they want to learn more about the artifact that the community is focused on (Handley et al. 2006) or have a specific need (Shah 2006). User communities also allow an individual to find like-minded people that share a common interest in a particular artifact. For some, this generates a sense of belonging that leads to continued active participation in the community (Lampe et al. 2010). Turning to community-focused intrinsic motives, reciprocity can be a motivator in user communities—both for those heavily involved in the community and for those that participate less frequently (Chan and Li 2010; Lakhani and Hippel 2003; Shah 2006). Reciprocity represents a sense of obligation to contribute when others have helped a user in the past. Additionally, belief in the mission of the user community is a frequently cited reason for participation, although this is a much stronger motivation for individuals who participate frequently than individuals who participate occasionally (Lakhani and Hippel 2003).

While intrinsic motivation refers to doing something because it is inherently interesting or enjoyable, extrinsic motivation, refers to doing something because it leads to a separable outcome (Ryan and Deci 2000). Extrinsically motivated activities often include a reward for demonstrating the desired behavior, coupled with the threat of punishment for misbehavior. Status enhancement and career benefits have been documented in user communities. Status within the community can serve as an extrinsic motivator: in many communities, there are no official status measures, but

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[10] And, more generally, that motives propelling different activities—e.g., asking questions, answering questions, creating a feature, working to integrate others' work into the master design—may differ.

members get to know who provides knowledge, insights, and work effort over time; while in others "scores" documenting participation levels or the usefulness of answers to others may be used as status indictors. For example, on TopCoder, a software development platform, and StackOverflow, a coding question and answer site, individuals frequently contribute their time and effort to see their name climb the ranks of various leaderboards (Archak 2010). In the context of Wikipedia, status enhancements, even when purely symbolic and not extending beyond the boundaries of the community, like simply having a digital badge next to one's name, have been shown to increase the number of contributions a participant makes and can also increase commitment to the community (Gallus 2016).

Career benefits can also serve as an extrinsic motivator: by participating in a user community, an individual can signal the possession of existing skills to employers, as well as learn (and signal) new skills.[11] Studies have shown that participation in user communities can lead to valuable learning experiences that enhance an individual's ability to get a job in the future in fields as disparate as graphic design (Brabham 2010) and programming (Hann et al. 2002). While career benefits occur, it is an open question as to whether individuals participate to gain those benefits or if those benefits come as a result of participation pursued for other reasons.

Participants' motives often evolve, with the reason for continued participation being different from the reasons for joining the community (Lampe et al. 2010; Shah 2006). Several such patterns have been documented. For example, in a study of two open source communities, Shah (2006) found that many participants joined because they needed to use the software and using the software required having some questions answered or components built; individuals who continued to participate often did so because they enjoyed the act of coding and participating in the community. As they did so, they generally increased the scope of their participation, fulfilling more community support and organization tasks rather than focusing only on their own needs.

Paid participation is increasingly common in open source communities. Paid participation usually occurs when an individual's employer pays them to contribute as part of their job or when the organization behind the community pays an individual for them to participate (Nagle 2018b). Paid participation in the Linux kernel appears to have risen over time, with rates around 40% in

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[11] Status enhancement can also serve as a method for signaling career benefits.

the early 2000s[12] (Herrmann et al. 2003) and 92.3% in 2016 (Corbet and Kroah-Hartman 2016). Paid participation rates for communities in other product domains are not known, but appear to be far lower. A number of motives have been documented and/or suggested to explain the choice of firms to support participation in open source software development[13], however these reasons are likely distinct from the reasons that employees of these firms engage in the work, although they may shape the work that employees take on and the decisions they make. Hence individuals employed by firms to work on open source projects may experience not just a variety of motives, but conflicting directives as well; to our knowledge, no research exists on this issue.

Control & Governance

Because user communities are very different from traditional firms and organizations, their social structure has been a frequent topic of study within the literature. Elinor Ostrom's work on governing the commons (Ostrom 1990) has strongly influenced and shaped the study of user communities, with early legal scholars characterizing user communities as commons (Benkler 2006; Frischmann et al. 2014). Ostrom and her collaborators conducted many detailed empirical studies and carefully defined the boundary conditions and characteristics of the commons she studied. Although both are commons, user innovation communities are quite different from Ostrom's commons. Several characteristics of community governance have been suggested as important and have been highlighted in the literature.

Open & Fluid Membership. Communities tend to embrace new members and various levels of participation with members participating once or a few times, sporadically, regularly, or even taking on maintenance-related work. In fact, individual contribution levels in user communities

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[12] The study found that 20% of the developers were paid to contribute as part of their regular job and another 23% were sometimes paid for their Linux work (Herrmann et al. 2003).

[13] These include gaining innovation-related knowledge and feedback (Dahlander and Magnusson 2008; Feller and Fitzgerald 2002; Franke and Shah 2003; Gabriel and Goldman 2005; Harhoff et al. 2003; Henkel 2006; Henkel et al. 2014), standard setting (Goldman and Gabriel 2005; West and Gallagher 2006), gaining adopters (Henkel et al. 2014; Raymond 1999; von Hippel and von Krogh 2003; West 2003), increasing demand for complementary products and services (Feller and Fitzgerald 2002; Fosfuri et al. 2008; Henkel 2009; Lerner et al. 2006; Lerner and Tirole 2002; von Hippel and von Krogh 2003) or proprietary versions of the software (Goldman and Gabriel 2005), helping consumers avoid lock-in (Gabriel and Goldman 2005; Grand et al. 2004; Henkel et al. 2014; Raymond 1999; Zhu and Zhou 2012), displacing existing products (Aksoy and Shah 2018), enabling compatibility (Henkel et al. 2014; Mustonen 2005), reducing maintenance costs (Henkel et al. 2014), reducing production costs (Henkel et al. 2014), training and education (Goldman and Gabriel 2005), and scouting for potential employees (Lerner et al. 2006) Unfortunately, it is also possible that payments may be made by those with disingenuous motives, such as competitors within an industry (Luca and Zervas 2016; Mayzlin et al. 2014).

frequently follow a power-law distribution where a few users contribute a great deal and a majority of users contribute only a small number of times or not at all (Rullani and Haefliger 2013).[14]

Openness and fluidity benefit the community, as new or infrequent participants bring in new problems to be solved as well as new knowledge and insights that might be helpful in generating solutions: Eric Raymond (1999) refers to the latter as "Linus's Law"—"given enough eyeballs, all bugs are shallow." Or, more formally, "Given a large enough beta-tester and co-developer base, almost every problem will be characterized quickly and the fix obvious to someone" (referred to as "Linus' Law", Raymond 1999, p. 30).[15] Unpacking and extending this concept, we suggest that users with different knowledge bases can often complement one another, leading to the pooling of information that generates solutions. By allowing and even encouraging open and fluid membership, communities can bring in more knowledge, both related to problems and solutions, that then fuels further development. Overall, the time an individual contributes to a community may not always square with the value of their contributions to the community: individuals possessing novel problems or knowledge or strong problem-solving skills may be very valuable, despite generally low levels of participation.

Transparency. Communities also tend to embrace transparency in both their creation efforts and their communications. Transparency refers to the practice that all participants in the community can access shared information, request information from others, and identify the source of that information. Transparency helps encourage the future growth of the community (Demil and Lecocq 2006). Transparency promotes trust amongst community participants, which in turn encourages participation (Benlian and Hess 2011).

Maintaining the Commons/Property Rights. A key characteristic of user innovation communities is their dedication to maintaining and building the commons. All communities that we have observed expect that content contributed to the commons will remain available for all to use: while participants can use that content for their personal use and for commercial use, they may not

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[14] Those who contribute more (and also tend to participate over longer periods of time) have a greater say in decision-making (Rullani and Haefliger 2013). They are also likely to better understand the design of the artifact itself and therefore be instrumental in suggesting how new ideas be integrated into the overall design.

[15] Users can build knowledge through a variety of experiences, including being involved in multiple user communities. For example, "cosmopolitans" are not necessarily in the core of the community, but they are involved in *multiple* user communities and can bring lessons learned in one community to others and are hence critical to the success of communities (Dahlander and Frederiksen 2012).

prevent others from using it. Some communities take this as a given, but uncodified rule, while others, particularly in digital domains, have created explicit licensing terms around this concept.

While continuing to build the commons is critical to all communities, communities take different approaches regarding whether the additional content an actor builds atop what already exists needs be contributed back to the commons. For example, in the context of software, a number of open source licensing arrangements exist.[16] Some have copyleft provisions requiring that derivative work be contributed back to the community.[17] Other open source licenses, however, do not include the requirement that resulting copies or adaptions also be released under copyleft. These are referred to as "permissive licenses." Permissive licenses are, according to the Open Source Initiative, "non-copyleft licenses": while they also guarantee the freedoms to use, modify, and redistribute, they allow proprietary derivatives. Communities appear to thrive under both styles of licenses: the Linux community utilizes a non-permissive license (the Gnu General Public License or GPL) and the vibrant Apache software community utilizes a permissive license (the Apache License).

Master Designs & Maintainers. Some communities keep master designs that have been well tested, which individuals can access and use. Individuals can then use these designs as is or alter them as they wish. The manner in which features to be embedded in the master design are selected requires further research, but it appears that "maintainers" use their discretion and knowledge to make these decisions. "Maintainers" are participants selected for their knowledge and efforts who have access to the core design; in a number of open source communities, "election" requires three individuals supporting an individual to suggest election on a mailing list and no objections from others.

Decision-Making & Conflict Resolution. Decision-making in communities often centers on what changes are made to the master design; this is because individual users can readily alter their private copies of the artifact and are encouraged to do so. In general, decision-making in

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[16] Note that a variety of open source licenses exists and have certain key features in common, as defined by the Open Source Definition: they allow software to be freely used, modified, and shared (Open Source Initiative 2018).

[17] Copyleft is a subversive use of intellectual property concepts, particularly copyright (Coleman 2012; Lessig 1999; Stallman 2001). *Copyright* law is used by authors to prevent others from reproducing, adapting, or distributing copies of their work. In contrast, by using copyleft, an author gives others the permission to reproduce, adapt, or distribute their work—with the requirement that any resulting copies or adaptations are also bound by the same licensing agreement. As Coleman (2012) argues, by *organizing work* in radical ways, open source software development shows that the assumption that economic incentives are necessary for vibrant creative production is false; F/OSS functions as a living counterexample to proprietary intellectual property law.

communities is distributed, however, communities do have different ways of handling critical decisions: some communities may hold votes amongst key or all members, whereas others might rely on a central authority or "benevolent dictator."

Distributed decision-making can be supported through the use of modularity (Baldwin and Clark 2000b). Some user communities, particularly those centered around complex artifacts, use modular design as a tool to support the coordinated actions of multiple participants without a centralized decision maker (Baldwin and Clark 2000b). Modules are smaller, self-contained pieces that are designed to work together according to a formal architecture or plan. Modularity also allows for more flexibility and easier reuse of prior efforts in future projects within the user community. For example, OSS is frequently more modular than its closed-source proprietary software counterpart which allows for more flexibility when building future iterations of a project (MacCormack et al. 2006). The decision-making process can change over time: often when a community emerges, a central individual(s) makes decisions, and over time more democratic mechanisms evolve (O'Mahony and Ferraro 2007).

When disagreements arise in communities, they tend to be resolved through discussion and actual prototyping to investigate the merits of different directions. There are times when disagreements are so severe that they lead to a split of the community into two separate communities. In OSS this is often referred to as forking, which is what has led to hundreds of different versions of Linux.

Under What Conditions Will User Communities Operate?

We now consider the conditions under which user communities will operate. This question is critical as user communities are so different from firms and academic institutions: one might expect a firm to form when the opportunity to profit exists and this objective can be better met by organizing (*e.g.,* Barney 1991; Coase 1937; Wernerfelt 1984). However, in the absence of a direct road to profit, what conditions will support the continued functioning of a user community?

To investigate this question, we first delineate the type of exchange that characterizes user communities: generalized exchange. We are accustomed to thinking of exchange as restricted exchange: a transaction between two actors, a recipient and a donor, that creates an obligation to the donor (Ekeh 1974; Yamagishi and Cook 1993). In contrast, in systems predicated on generalized exchange, the recipient repays an obligation to someone other than the original donor

and no obligation to a specific donor is created; these systems comprise three or more actors.[18] The use of generalized exchange as a system matches the focus on knowledge development in user communities: to support innovation, knowledge needs to flow from those who have it to those who need it. However, because not all knowledge is the same, nor equally distributed, and not all community participants will innovate, a matching process based on restricted exchange would likely collapse, whereas one based on generalized exchange can allow ideas and knowledge to circulate more broadly.

Existing theory provides three reasons for why individuals might engage in generalized exchange: altruism, group norms, and rational action and enforcement (Dawes 1991; Olson 1965; Sahlins 1965). In altruism-based explanation, concern for the well-being of others leads to participation and support of others. In group norms-based explanations for generalized exchange, cooperative norms, trust, and/or solidarity leads individuals to give without expecting. Finally, in rational action and enforcement-based explanations, economically rational players cooperate to achieve instrumental goals, under strong supervision and a system of incentives. However, these explanations do not fit our understanding of how user communities function. There is little evidence of altruism in user communities (Lancashire 2001), and most participants contribute only questions and not answers. With respect to group norms, we have not yet come across a community with norms mandating that individuals give without expecting (although communities do have norms about process and how participants will treat and interact with one another). Moreover, most communities are largely composed of transient actors, with a committed core of members and a less committed (but much larger) periphery (Rullani and Haefliger 2013), hence it is unlikely that trust or solidarity is supporting contributions. We see little evidence to support explanations based on rational action and enforcement: both creating and contributing knowledge require effort, yet the community provides few benefits in exchange for these acts, beyond some status within a community and the ability to share excitement and enjoyment with others. And, we do not know of communities that enforce (mandate) contributions.[19] And, to cement that point, free-riding

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[18] Several flavors of generalized exchange exist. In individual-focused generalized exchange one individual reaps the benefits of the group's effort (*e.g.,* barn raising). In group-focused generalized exchange, individuals work together to create a shared resource that all will benefit from (*e.g.,* digging a well). In network generalized exchange, an individual or group help someone in a manner that benefits only that person, but they expect that the recipient of the benefit will "pay it forward" to others that are in a similar situation (*e.g.,* helping a stranded driver).

[19] The closest we observe to this is the practice, used with some open source software programs, of having direct error-reporting.

(using the product or service without giving back) is generally accepted and even encouraged in many communities and can be beneficial to the overall health of the community. This lack of evidence in support of existing explanations for generalized exchange suggests a need to build additional theory to better explain the conditions that will support the generalized exchange of *knowledge within user communities*.

Here, we theorize the conditions supporting generalized exchange within user communities. Building on the existing literature, we suggest three conditions: heterogenous needs, a focus on the exchange of non-rival goods, and participation by at least a few individuals who benefit from the act of contributing to the community.

Heterogeneous needs. The individuals in a user community are often engaged in a number of diverse tasks around a focal product or service. For the community to be useful to such a diverse set of potential "innovators," a variety of knowledge will need to be present. Hence, user communities need to attract a diversity of knowledge and skills to accomplish a variety of tasks. Some of this diversity will come naturally. For example, in the community of bicycle enthusiasts, participants all enjoyed bicycling, but had different careers (Lüthje et al. 2005). The early community that duplicated and verified the design of Binnig and Rorer's probe microscope tended to be scientists, but came from a variety of scientific fields. We therefore expect that communities that are more open and welcoming of various types of people will be more successful in fostering innovations. Seen from this perspective, user communities' encouragement of use—even through "free-riding"—serves to draw a greater variety of people in, a few of whom will contribute

Exchange of non-rival goods. We suggest that user communities will tend to focus on the exchange of non-rival goods. By definition, non-rival goods are those goods that can be consumed without reducing the amount for others to consume. As a result, the marginal cost of providing goods to an *additional* individual is zero or very low; this requirement fits user communities where knowledge, ideas, or even digital goods are likely to be the objects of exchange, and once knowledge is developed, the costs of communication tend to be relatively low.[20] This condition means that sharing will not decrease the benefits that any individual obtains from their own use or consumption of the information. Even further, many of the goods produced by user communities could be considered network goods that either have direct or indirect network effects such that the

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[20] Note that the *initial* production or acquisition cost of that knowledge may be costly or time consuming, however, our focus here is on the costs of further propagating that knowledge.

more users that use the good, the more value the good provides for every user. For example, as more people use the Linux operating system, more applications will be developed for it, which makes it more valuable.

Gaining by contributing. Communities are able to develop and improve artifacts only through the contributions of participants. However, the act of contribution—documenting and communicating knowledge—requires time and effort, but does not *directly* benefit the individual. Hence, there is an opportunity to free-ride, by benefitting from others' contributions while not contributing oneself. Scholars have suggested that, for a robust user community to form, some individuals must expect to gain from contributing knowledge (Allen 1983; Nuvolari 2005). The benefits gained might arise from the exchange and development of knowledge (*e.g.,* the individual becomes known as the creator of the knowledge and later commercializes it, or others build on and refine the idea such that the individual can benefit from those developments), from the process of contributing and interacting within the community (*e.g.,* enjoyment, self-efficacy, sense of belonging, status, etc.), or from learning how to more efficiently use the good produced by the user community (Nagle 2018b). With respect to the latter, research on user communities in the fashion industry has shown that it takes time for contributors to learn from others who contribute, but when they do, they learn from both good and bad examples of quality products (Riedl and Seidel 2018).

Relationships Between Firms & User Communities[21]

Working with user communities requires firms to change their frame of reference—moving from a hierarchical, employment-based model of interaction to a community-based model. Firms must learn to work with user communities, but not stifle their activity so that both can grow in a healthy symbiotic relationship; more specifically, Altman et al. (2019) suggest working to leverage communities without exploiting them and sharing intellectual property. This can be very challenging for firms engaging with communities for the first time; it may be more natural for firms that are born from the community, but even then, it may become challenging as both the community and the firm grow and begin exploring unexpected directions. Below, we describe the general ways in which firms can participate in a community, discuss what is known regarding

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[21] We focus on firm engagement with user communities, however we believe that many of the issues and patterns discussed will apply to other types of organizations engaging user communities (e.g., non-profits, government agencies, universities).

issues of governance and control between user communities and firms, and provide some examples of how relationships between firms and communities transitioned over time.

Roles Firms Play in User Communities

Firms and user communities can interact in a variety of ways. Here we acknowledge three very general categories of participation to illustrate the choices that firms have when interacting with user communities. *Participant.* Some firms choose to simply participate in a user community. They might pay employees to participate in the community and guide those employees and their work, but, officially, each of those employees enters and participates in the community in the same way as an independent participant would. *Organizer/Supporter.* Firms can also take on strong organizing or support roles for the community. For example, firm employees might act as moderators or managers of the user community (in contrast to acting as an individual participant). Firms might also provide resources for communities. *Founder.* User communities can arise organically, with users self-organizing to improve an existing artifact or create an altogether new one, or they can be actively founded by a firm (or other organization) that produces the artifact for commercial sale. As an example of a community that arose organically, consider Linux. In 1991, Linus Torvalds sent out a message requesting help from fellow software developers (Torvalds 1992):

> *Hello everybody out there using minix -*
> *I'm doing a (free) operating system (just a hobby, won't be big and*
> *professional like gnu) for 386(486) AT clones. This has been brewing*
> *since april, and is starting to get ready. I'd like any feedback on*
> *things people like/dislike in minix, as my OS resembles it somewhat*
> *(same physical layout of the file-system (due to practical reasons)*
> *among other things).*
> *I've currently ported bash(1.08) and gcc(1.40), and things seem to work.*
> *This implies that I'll get something practical within a few months, and*
> *I'd like to know what features most people would want. Any suggestions*
> *are welcome, but I won't promise I'll implement them :-)*
>   *Linus (torv...@kruuna.helsinki.fi)*
> *PS. Yes - it's free of any minix code, and it has a multi-threaded fs.*
> *It is NOT protable (uses 386 task switching etc), and it probably never*
> *will support anything other than AT-harddisks, as that's all I have :-(.*

Other communities, such as Threadless and LEGO IDEAS, were purposefully created by firms.

Relationships Change Over Time

The role a firm plays in a community as well as the level of control it attempts to exert

can change over time. For example, The Harley Davidson Owners Group was initially created by enthusiastic Harley owners and not affiliated with the firm. For many years, Harley-Davidson motorcycle enthusiasts would regularly get together in their local community to go for rides and spend time together. Harley-Davidson decided to formalize these groups and offer them support by creating the Harley Owners Group (HOG) in 1983 to allow users an even more intimate experience with the brand and product (Harley-Davidson 2019). However, Harley-Davidson chose to exert a limited amount of organizational control over HOG in an effort to maintain the group's authentic feel. Users continued to embrace HOG; the community grew and thrived and was an important part of the revitalization of the Harley-Davidson brand in the 1980's and 1990's. Further, this low-level of involvement limited the resources required for Harley-Davidson to support and help grow the community.

In contrast, we see a less successful example in the relationship between MakerBot, a company that makes 3D printers, and Thingiverse, the user community it created to allow users to post 3D designs. When first launched, Thingiverse allowed users to maintain control over their designs. However, in 2012, MakerBot announced plans to change the terms of use such that MakerBot would own all of the intellectual property rights associated with the designs (West and Kuk 2016). This claim of legal ownership caused an outrage amongst existing Thingiverse users to the point where many left the community to go elsewhere so they could retain ownership of their designs. Similarly, in the context of drones, the relationship between the community and a manufacturer, 3DR, was disrupted when the firm received venture financing and obtained proprietary protections for its intellectual property (Bremner and Eisenhardt 2019). It is often such changes in levels of organization and control over ideas by the firm that can lead to a downfall of a user community. Therefore, the levels of organization and control must be thought of as dynamic and not static. When a firm takes over an existing user community, or when it changes the level of organization and control associated with the community, there is a risk for upsetting users and destroying the community.

How Can Working with User Communities Benefit Firms?

Scholars have documented a number of ways in which user communities can create value for firms (e.g., Chesbrough et al. 2018).[22] Broadly speaking, firms can build competitive advantage

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[22] User communities are distinct from other methods whereby firms seek to gain information from consumers, such as focus groups and customer surveys in several ways. User communities are composed primarily of users—

through a differentiation strategy or a low-cost strategy—and user communities can be utilized, in different ways, to achieve either of these ends. User communities can be used to differentiate a firm's offerings through innovation, branding, increasing integrity/identifying recurring problems. User communities can also be used to lower costs through the provision of limited product support (especially for products and services that are or have been phased out) or informal support for hiring and training. Below, we detail each of these five benefits, noting that others may exist. While working with user communities holds promise for firms, we stress that user communities do not exist to support firms: participants can and do choose what tasks to engage in and, outside of the power of suggestion, firms do not have control over participant decisions. We also note that there are areas in which communities may not be able to support firms, such as the collection of standard marketing data (although they will provide data on what community participants value; note that community participants may or may not be representative of the current consumer population, although in a number of cases, community innovations foreshadow general market trends), refinement of designs, and scaling production; corporate engineering, strategy, and marketing employees may be far better equipped and incentivized for such tasks.

Innovation & Product Development

Innovation and product development have long been known to be critical to the success of firms (Teece 2010), and user communities have been shown to be able to contribute to the generation of innovations in a variety of different industries. Firms can leverage user communities to gain access to novel artifacts, new features and functionality, and/or gain feedback on design. For example, user communities have created altogether new product categories such as probe microscopes (Mody 2011), therapies for a variety of ailments (Zejnilovic et al. 2015), and the first windsurfing board, skateboard, and snowboard (Shah 2005). User communities can also be used to harness ideas for new features for existing artifacts, as users will often seek to use existing artifacts in novel ways or contexts not originally envisioned by the manufacturer and requiring the

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individuals with a need related to the artifact or its use, whereas the average consumer may be relatively satisfied with commercial products on the market. User communities are much more than a conduit for providing firms with information; communities can and are created by users to achieve their own goals—whatever they may be (see section on motivations)—and do not exist to benefit firms, although they may provide a firm with benefits. In addition, traditional methods of interacting with consumers tend to be structured as one-off events, whereas user communities are organizations that continue over time. As well, focus groups and customer surveys tend to be focused on a small number of explicit features or ideas, in contrast, user communities are open-ended, and can provide feedback on current products as well as ideas and prototypes for novel features that might be integrated into a future version of a commercially produced product.

creation of novel or strengthened functionality (von Hippel 1988). There are many cases of new products and new product features first being developed within user communities and only later commercialized (Shah 2005; Shah and Tripsas 2007); in some cases, communities even helped evolve and identify dominant designs, which were used as a starting point for the earliest firms in the industry (Bremner and Eisenhardt 2019; Mody 2011). The firm can accelerate this process by providing innovation toolkits to its users (Franke 2004; Franke and von Hippel 2003; von Hippel and Katz 2002).

User communities can also be a valuable place to seek feedback on innovative designs developed *inside* the firm (Aksoy and Shah 2018; Gabriel and Goldman 2005). As mentioned above, user communities are different from traditional focus groups in that they are made up of individuals who are already interested and engaged users of an artifact and who have often tinkered with or made copies of the artifact and hence possess the ability to understand and advance a design. Engaging feedback from such individuals can provide the firm with information to improve the artifact prior to commercialization.

Firms seeking to integrate user communities into the development cycle will need to shift their view of product development from a linear one involving the firm as the starting point and the customer as the end point to a more nuanced one where users are an integral part of the development process (this involves both acknowledging the role and making room to integrate feedback over time and multiple product generations or updates). Firms should also consider the importance of creating modular designs (Baldwin and Clark 2000b): modularity may make it easier for the firm to incorporate user ideas into commercial products and make it easier for users to tinker with existing designs as they generate new ones.[23]

Branding

Firms can harness user communities to help strengthen their brand at limited cost (Muñiz Jr. and O'Guinn 2001). In particular, users' enthusiasm towards a product can be supported and cultivated to allow users to help advertise a product. For example, LEGO allows its users to create

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[23] Franz's (1999) historical study of automotive tinkerers in the early 1900s illuminates the costs and benefits of working with user communities. Automakers became frustrated with users' requests for novel features—features whose designs were circulating in upwards of two dozen hobbyist auto magazines in the period before the Great Depression—and warranty requests (after all, tinkering can also result in damage!) and Franz argues that the design of the one-piece autobody in the 1950s served as a means of *inhibiting* user innovation. Over the years, Franz suggests, U.S. cars became increasingly complex and less modular, which resulted in poorer design and difficulty in competing with Japanese automakers.

their own designs and share them with other users. They can also enter these designs into a contest and winners have their designs turned into actual products sold and marketed by LEGO (Antorini et al. 2012). In addition to reducing innovation costs, this often leads to an increase in authentic, word-of-mouth advertising as users promote designs that they created or designs they find attractive within their own networks. Similarly, Starbucks offers a forum for its customers to share and discuss ideas to improve the Starbucks experience. The company highlights those customer ideas that are adopted which leads to an increased commitment by the loyal user base. Even products that are only purchased every decade (rather than every day) can build user communities to encourage brand loyalty and the purchase of branded complements and peripherals. For example, the motorcycle companies Harley-Davidson and Ducati both nurture their user communities and sell various complements (clothing, patches, etc.) that committed users will purchase and wear, which increases brand awareness—loyal users are literally paying the company for the privilege of advertising for them. In this way, user communities can serve as an interactive channel to the customer through which firms can manage the perception of their products (Goh et al. 2013).

Increasing Integrity/Identifying Recurring Problems

Problems occur with any product and some are one-offs, while others reflect a systematic design or manufacturing flaw. User communities have been helpful in bringing such flaws to light and showing that a number of users are experiencing the same issue, which can occur, when, for example, an individual begins by noting a problem they have had—and then others echo the same issue. For example, Microsoft's Xbox Ambassador Program is an official user community sanctioned by the company where users help other users and can elevate issues that multiple users have to bring them to the attention of Microsoft (Harrison 2016). More cynically, this function of user communities might be seen as a way of keeping companies honest.

Product Support

User communities can and have provided product support, for both existing products and discontinued ones; although in known cases, this support was targeted at expert or at least highly enthusiastic (even devoted) users. For existing products, community participants will often interact to ask various questions, ranging from general product support (which can also be addressed, presumably by a firm making a product) to how to use the product in special conditions or contexts, which might involve design modifications or changes in how the product is used. For example,

Stata, the statistical software package, relies heavily on the Statalist user community as a place for product users to go for technical support, reducing the costs associated with hiring full-time customer support employees (although standard support options continue to exist). User communities also provide product support for discontinued products. For example, a user community formed around the Apple Newton, an early personal digital assistant, shortly after the product was launched in 1993. Users were enthusiastic about the project and shared a variety of tricks and uses for the product. At the height of its popularity this community had nearly 200,000 members (Muñiz and Schau 2005). When Apple discontinued the Newton in 1998, the community also began providing product support: individuals who could no longer query Apple, could find answers within the community; individuals seeking spare parts could source them from others with parts to spare or a PDA to sell. The user community was so strong that it continues meeting in person and online even though the product was discontinued 20 years ago (Pierini 2016). Cisco Systems provides an example of a company that chose to rely on users' ability to support products: the firm strategically released peripheral drivers under open source licenses to reduce the costs of maintenance for older product generations.

Hiring & Training

User communities can also be leveraged to identify and train employees. A number of examples exist of firms hiring individuals who distinguished themselves and/or their skills while working in (or founding) user communities, and a few examples exist of startups being founded by community members and recruiting from the community as well (Bremner and Eisenhardt 2019; Mody 2011). By using communities to identify potential employees, firms can gain greater insight into the candidate's skills and increase the chances that they are hiring someone with a true passion for the activity and artifact. Other companies have begun to use user communities as part of their employee training programs, where new technical or customer support employees can see– –in real time—the kinds of issues that customers are experiencing and try to resolve those, learning more about both the firm's customers and product, in the process (author interviews).

Trade-offs Involved with Working with User Communities

We now turn to two tradeoffs that firms will encounter when working with user communities: decreased control and a potentially limited participant set.

Decreased Control

User communities operate outside the boundaries of the firm (Argyres and Zenger 2012; Zenger et al. 2011)—even in cases where the community organizes around a firm's core products––and firms can therefore not control communities via traditional hierarchical methods. Instead, they can set rules of behavior in an attempt to influence without control (Altman et al. 2019; Nagle et al. 2018; Nickerson et al. 2017)—what Altman et al. (2019) refer to as "shepherding" communities. Doing so, however, requires firms to understand and abide by the community ethos.

Individuals participate in communities on their own accord, and they choose when and how they will contribute. For firms, this means that a large portion of the element of "control" in decision-making is gone. This type of organizational environment can be difficult for firms and their employees—used to managing the ability to strictly manage both the content and timeline of projects—to adjust to. One large software firm, for example, uses a process that might be described as an interlinked chain to guide their work within open source communities: a set of employees who work closely with the firm's clients identify changes and additions to be made to the open source code base, those ideas are then communicate to a manager who relies these ideas to a separate set of employees whose job it is to work on code within the open source community (author interviews). At the same time, the benefits of decreased control can also be immense: the ideas of a larger number of people can emerge within an open source community and the firm can choose amongst those ideas. Working within an open source community requires a special kind of employee: one comfortable with sharing their (even initial) ideas and work broadly, getting feedback from the outside, and willing to accept and improve based on this feedback (author interviews). Many employees are uncomfortable sharing early-stage work products publicly and soon ask to be reassigned to other software-related positions.

Scholars suggest that firms pay careful attention to the governance and control practices used by communities discussed above (Altman et al. 2019; Shah 2006; West and O'Mahony 2008). Firms acting counter to the community ethos might face resistance or rejection from the community. For example, user communities are centered around the notion of making knowledge free for others to use, adapt, and share. Not surprisingly, efforts by firms to exercise intellectual property rights over ideas developed by users have met with resistance and even the rejection of the firm by the community, as happened to Santa Cruz Operations (SCO) when it argued it owned portions of Linux and attempted to extract license fees from all users of Linux. More generally,

studies have established that governance choices influence users' participation behaviors and that communities founded by firms are often governed differently than communities founded by users (Shah 2006; West and O'Mahony 2008), yet there is much more to understand about how governance choices affect both communities and firms (see section on Opportunities for Research).

Participants May Not be Representative of Customers

For firms looking to user communities for product feedback, there may be another downside as well: community members may be different from the average consumer in numerous ways. In addition to being ahead of the curve, more innovative, or more enthusiastic, they might reflect only a subsegment of the firm's consumer population. For example, user communities in many fields are largely male, whereas product users may not be so skewed (*e.g.,* operating system software or communities of auto or sports equipment enthusiasts); or participants may be extreme users along multiple dimensions (*e.g.,* using the artifact in extreme conditions, using the artifact in ways that non-mainstream users may not, in their ability to work with a complex rather than simple or streamlined design, etc.). This has occurred in many industries, including software, sports-equipment, and drones. This might result in product ideas useful to only a subsegment of customers or that need to be adapted.

Opportunities for Strategy Scholars: Measuring Impact & Uncovering Process

There are a number of opportunities for strategy scholars to contribute to the study of user communities, as well as a number of ways in which the study of user communities can contribute to theoretical insights within the field of strategic management. In this section, we detail those avenues. This section is organized around two central issues: understanding the processes underlying firm-community interactions and measuring the impact of user communities.

We believe that empirical research is critical to improving our understanding of user-community and firm relationships: as described above, user communities are very different from more frequently studied organizations such as firms and scientific institutions. Such differences require scholars to carefully consider their assumptions as they craft, execute, and present their studies. Scholars need to be alert to the fact that user communities are complex and thus take a nuanced view when trying to understand communities and their relationships with firms. Attempts to explain patterns with a single overarching mechanism may not be accurate, no matter how theoretically attractive or elegant.

To understand how firms can work within user communities, we need to observe how both communities and firms operate individually and together. Doing so can be challenging on several dimensions. Scholars wishing to study these issues will need to develop novel study designs that allow for examination of the processes at play, as the field is growing and general templates for study designs are just emerging. Throughout this paper, we have tried to highlight empirical work that may be useful as a starting point. We recommend that both qualitative and quantitative scholars begin by trying to understand the relationships between different categories of participants and the umbrella of norms and rules that shape their interactions; unique techniques like structural sampling (Shah and Gorbatai 2016) and the use of mixed methods study designs may be particularly valuable (Fine and Elsbach 2000). In addition, a variety of methodological skills are needed to address these questions, making the field ripe for entry by scholars possessing a variety of methodological skills and tools, and knowledge of various actors. Finally, changing knowledge around user communities is leading to changing patterns: as firms engage more with communities––either as users themselves or as "consumers" and "commercializers" of community-developed knowledge—relationships (between variables) and participation patterns may change.

Understanding Process

Here, we focus on suggesting ideas for research intended to better understand how user communities and firms can effectively work together. We structure our suggestions for future research around four general areas.

Seeding New Ventures & New Industries

As described above, new ventures in a number of industries stem from user communities. The conditions under which user communities—versus users working independently or other sources—seed an industry have yet to examined.[24] In addition, while scholars have observed that users receive feedback and interest from user communities that leads to subsequent commercialization decisions (Shah 2005; Shah and Tripsas 2007), the nuances and boundary conditions of this process have yet to be elaborated.

Understanding How Interactions Shape Firms and Communities

Research documents interactions between firms and communities existing for at least the past 100 years (Franz 1999). Firms often work with communities to gain information, or more

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[24] Indeed, scholars have just begun to systematically research the processes that precede, or incubate, the start of a new industry (Moeen and Agarwal 2017).

specifically, feedback on a particular product, idea, or feature—or, to shape the designs created by communities. However, we know little about how these interactions—and the information flows and feedback that they engender—impact either user communities or firms. Yet, as firms increasingly engage with external user communities, understanding the effects of these interactions becomes increasingly important. More specifically, there is little to no existing research that helps understand how community-firm interactions shape the work processes of either communities or firms. Hence, a question worthy of further examination involves how these interactions shape both the firm and community. Below, we breakdown this question into four component parts: information flows and feedback, governance and control, transparency, and legitimacy.

Information flow and feedback on ideas are critical to communities, both as processes and as outcomes. When firms become involved with communities, their processes and outcomes can be affected and vice versa. Scholars might ask: how does feedback from user communities shape a firm's commercial products, experimentation patterns, and decision-making processes? How does feedback from firms—or from community participants who are paid to work within the community by firms—shape a community's designs, experimentation patterns, decision-making processes, and participation patterns? For example, in the context of the Stata user group, it appears that the participation patterns of voluntary users are altered when they receive feedback from a Stata employee (Nagle et al. 2019).

As discussed earlier, governance and control are critical to ensuring the health of user communities. However, only a few studies conducted to date investigate the impact of firm involvement on the health and functioning of user communities (e.g., Jeppesen and Frederiksen 2006; Shah 2006; West and O'Mahony 2008). This is a critical area for research. Scholars might, for example, more deeply examine how each community governance mechanism shapes various outcomes and how contextual factors affect these relationships. They might also begin to investigate which of the suggested mechanisms are most central and if and how changes in each mechanism affect community functioning and growth. Scholars might also seek to understand the effect of increasing numbers of paid contributors into a community (as has occurred in the Linux community over the past ten years), particularly on the activities of voluntary participants. More broadly, the question of how firm involvement shapes which volunteers join and the extent to which they participate are open questions. With respect to the latter, for example, recent work in the context of digital mapping suggests that the entry of firms may disrupt the growth and activity

of existing user communities (Nagaraj and Piezunka 2018). The mechanism, is, however, unclear: for example, as a product and its design matures the community may be less critical, as occurred over time in the probe microscopy community (Mody 2006); the actions of the firm(s) may impede participation from voluntary participants, as occurred in an open source community that was firm-sponsored with restrictions on how participants could use the code (Shah 2006); or other users may simply choose not to do the work as the firm is doing it.

Transparency is also a critical issue. Within any collaboration, it is important to understand each actors' motives, as those motives will likely shape their ideas and the direction of the project. Issues of transparency in identity become increasingly important as firms become increasingly involved in user communities. For example, in the mid-late 1990's, IBM was quietly contributing to Linux, and only made public announcements about these efforts in 2000. When these efforts were uncovered, members of the Linux user community were concerned that IBM had exerted undue influence over the project. Today many companies contribute to Linux and appear to do so openly, yet it is not known how many "cloaked" participants—participants trying to hide or mask their identity—exist. This could lead to potentially damaging effects for both the community and firm, with respect to trust between participants, as well as outcomes.

From the perspective of the community, it remains unclear as to whether or not firm participation enhances or detracts from a community's legitimacy both in the eyes of its participants and outsiders. In some cases, firm involvement appears to add to a community's legitimacy and reach. For example, both Harley Davison and Stata become involved in preexisting user communities around their products, providing limited resources and official branding that appear to have increased legitimacy and reach of the communities (note that both communities continue to be managed by users): Harley-Davidson formalized existing user groups into the HOG community; StataCorp agreed to host the existing Statalist forum and allowed its developers to contribute to the Statalist forum and travel to international user group meetings. However, it is also quite possible that a firm takeover of an existing user community could be seen as delegitimizing and it could anger members of the community. This has been seen in the 3D printing context when MakerBot changed its licensing approach toward the open source hardware site Thingiverse (West and Kuk 2016) as well as the OSS context when Oracle (a proprietary database manufacturer) acquired Sun Microsystems, which owned the open source database MySQL as users of the latter feared Oracle would no longer offer it under an open license and decided to leave MySQL and

create a new OSS database (TechCrunch 2012). However, it is still not clear why in some cases firm participation is well-received by the community and in others it is not. The conditions under which firm involvement with a user community is legitimizing or delegitimizing have gone underexplored and are a fruitful area for research. Scholars might begin by examining the effects of the role played by the firm—participant, organizer/supporter, or founder—and the firm's compliance (or lack thereof) with community governance and control practices (actions that contradict practices are unlikely to be well-received and may lead users to leave the community or engage the community in only very limited and instrumental ways (Shah 2006, West & O'Mahony 2008); see also media coverage of conflicts between Makerbot and community principles (Biggs 2014; Smith 2012).

Collaboration with User Communities & the Changing Organizational Structure of the Firm

When a firm begins working with a community, it is likely to have an impact on the social structure of the firm. As pointed out above, Lifshitz-Assaf's research on NASA (Lifshitz-Assaf 2018) shows that engagement with a user community led to scientists questioning their identity and role in the organization. Interaction with user communities could necessitate broader social, cultural, and structural changes within the firm as well. It is feasible that entire departments (*e.g.,* customer support, R&D) could be offloaded to a user community, which would necessitate a shift in social structure. More likely is a partial shift to reliance upon a user community such that the firm needs to manage dual and competing institutional logics where it previously only managed one (Altman et al. 2019). Although there has been many theoretical explorations of how opening the firm to user communities may impact the organizational structure and governance of the firm (Appleyard and Chesbrough 2017; Felin and Zenger 2014; Gulati et al. 2012) there is almost no empirical work in this area at this time so our understanding of how this plays out in the real world is limited.

Changing the Nature of the Work: Tasks & Identities

As firms engage with user communities, the nature of work begins to shift. This has important implications for both employees of the firm and members of the community. When firms utilize community members to perform tasks that would have otherwise been completed by paid employees, the nature of work begins to change. For example, when Facebook wanted to translate its site from English to nearly a hundred other languages, instead of hiring translators, it asked the user community to help translate the site for free. Although the users got the benefit of having

Facebook available in their native language, Facebook reaped massive benefits with little cost. Even when community members are paid, there can still be changes in how employees think about their jobs and their identity. For example, in the related context of crowdsourcing, when NASA started using innovation contests to solve complicated problems, internal employees at NASA felt their identity as "problem solvers" was being called into question as their job evolved into "solution seekers" (Lifshitz-Assaf 2018). The impact of firms engaging user communities on both the community members and the firms' employees require further examination. Moreover, the question of how firm employees can work effectively with user communities—in a way that helps firms and their consumers achieve their objectives, while benefiting and maintaining the trust of the community—is an open one (see also the subsection titled "Decreased Control"). Finally, as discussed above, some user communities are heavily skewed with respect to their gender composition. Research is needed to understand why this is and how to create conditions that result in more balanced communities. Insights gleaned might also be applied to more traditional forms of organizing.

Measuring the Impact of User Communities

Now we turn our attention to the impact of user communities. As with many areas of the economy, measurement is a critical aspect of understanding user communities. However, their nature—limited organization, free availability, and not fully contained within traditional organizations—makes them difficult to easily measure with traditional tools (Greenstein and Nagle 2014).[25] Therefore, in this section we consider various open areas for exploration of how to measure the activity and impact of user communities.

Measuring the Economic Effects of User Communities on Firms

Perhaps the most important strategy-related question to firms with respect to working with user communities is whether or not engagement will benefit bottom line performance. A number of reasons for engaging with user communities have been suggested (Gabriel and Goldman 2005; Henkel 2006), and scholars have just begun to measure the effects of some of these strategies. To date, the evidence collected suggests that engaging with user communities to develop better products and internal systems has a positive effect on profitability. Specifically, evidence suggests

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[25] A few studies have examined the effects of working with individual users and/or user entrepreneurs on corporate innovation and revenue projections for new products (Adams et al. 2015; Chatterji and Fabrizio 2012; Chatterji and Fabrizio 2014; Lilien 2002; Shah et al. 2012; Smith and Shah 2013). These studies provide a useful starting point in thinking about *how* to gather data to measure the effects of user communities.

that working with user communities benefits corporate product innovation and can result in stock price increases when firms contribute in order to garner product-related feedback from users (Aksoy and Shah 2018). Working with user communities also appears to improve a firm's own internal productivity through learning; scholars have just begun to precisely measure these benefits (in areas using the artifact developed by the community) (Huang et al. 2016; Nagle 2018b, 2019; Riedl and Seidel 2018). More studies—across contexts and outcome measures—are needed to complement these few existing studies. Efforts to measure the effects of working with user communities on firms will play an important role in understanding how value creation and value capture are changing as a result of user communities.

Future research might also seek to document and measure the benefits of engaging user communities for reasons other than product development. For example, to measure potential costs savings from offloading key components of the firm's value creation process to user communities (*e.g.,* technical support). Another fruitful area of research are the competitive implications of a firm's engagement with user communities on competitors and other ecosystem actors. It has been argued that firms at one level of the value chain can band together to create open source alternatives to the products provided by an upstream supplier (Gambardella and von Hippel 2018), thereby reducing industry-wide value capture opportunities; but, scholars have yet to investigate this issue empirically. Finally, the cost-side of community participation has yet to be assessed: there are costs to working with or cultivating a community and these need to be better understood and measured.

Measuring the Economic Effects of User Communities: Entrepreneurship, Product Development & Industry Evolution

As discussed, user communities have served as the development site of a number of altogether new artifacts, ranging from probe microscopes and medical devices to sports equipment and juvenile products, *and* of some (and, in some cases, all) of the early firms that commercialized these artifacts (Baldwin et al. 2006; Mody 2006; Shah and Mody 2014; Shah and Tripsas 2007). In these cases, user communities *seeded* the industry and, by doing so, laid the groundwork for economic activity. In other cases, user communities contribute to existing industries by providing product ideas, branding, etc. The value of this activity—in terms of economic profit, job creation, consumer surplus, etc.—has yet to be measured.

Existing data suggests that the role played by users, user entrepreneurs, and user communities in industry evolution is worthy of further study.[26] A review of the literature on industry evolution suggests that user entrepreneurship is more frequent in the early and late stages of an industry (cf. review in Agarwal and Shah 2014).[27] Scholars have yet to investigate why this is. Other issues worthy of study include: the role of user communities in nurturing entrepreneurship at different stages of the industry life cycle; the effects of user communities on product evolution; and how and when users use of various forms of organizing—originator's circles, user innovation communities, *innovation nexus*, and commercial production—to meet their goals (Shah and Mody 2014).

Understanding the Dark Side of User Communities

Much of the existing literature on user communities examines the positive effects of user innovation and user communities, as do we in this essay. However, user communities can have a darker side as well. Communities can introduce artifacts that compete with or displace existing products, creating a free competitive threat against firms that may (or may not) be limited to specific market segments. For example, in the Halloween documents (Harmon and Markoff 1998). Microsoft discusses the threats posed by Linux. However, scholars have also argued that, in some situations, it is possible for such duopolies to coexist (Casadesus-Masanell and Ghemawat 2006). Communities can also revolt against firms, choosing to recreate products that firms produce. For example, ideologically-driven open source software developers claim to be doing just this— making software and code that is free from corporate control by creating free versions of commercial products (O'Mahony 2003). Understanding the extent to which communities pose a threat—and how firms can respond—is worthy of investigation. We suggest that this threat is greater—at the moment—in digital goods than in physical goods, however the rise of 3D printing

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[26] In this subsection, we again try and focus on issues central to user communities. However, it is worth pointing out that the effects of users (in general) and user entrepreneurship are still in the early stages of study.

[27] While data on user-founded firms supported by user communities is not available, we do have data on the prevalence of user entrepreneurship. Overall, according to Kauffman Foundation data, 46% of U.S.-based start-ups that survive to age 6 are founded by users (14% of all startups) (Shah et al. 2012). In the medical device industry, 52% of startups receiving corporate venture capital (CVC) investment and 29% of firms overall are founded by physician (user) innovators (Smith and Shah 2013). In the juvenile products industry, that number rises to 84% and in probe microscopy all new firms were founded by users (Mody 2006; Shah and Tripsas 2007). In the semiconductor industry, 34% of firms are founded by user entrepreneurs (Adams et al. 2015). Very limited data are available on the relative survival of user entrepreneurs (Adams et al. 2015; Agarwal and Shah 2014). Our understanding of how firms from different knowledge sources—users, academic science, or established firms—each contribute to the industrial ecosystem and interact with each other is limited (Agarwal and Shah 2014); more research is needed.

may alter this in time (Davis 2016); greater for the segment of consumers with technical knowledge and skills, particularly those who enjoy "tinkering"; and greater in cases where designs can be made easy to use or easier to alter through toolkits (Franke 2004; von Hippel and Katz 2002) and/or modularity (Baldwin and Clark 2000a; von Hippel and Katz 2002).

User communities can also have a more direct dark side that has yet to be explored. For example, in the 3D printing world, where users create and openly publish design documents, there has been a long-running legal battle between the United States government and Cody Wilson. Wilson published plans for a 3D printed gun and was then forced to take them down due to arms control export restrictions. However, he sued the US government on the basis of free speech and won the court case in 2018 (Greenberg 2018).

Conclusion

Communities of innovative users contribute to the innovations that we use on a daily basis and shape the industrial landscape. User communities active from as early as the mid-1800s have been documented in the academic literature (Nuvolari 2004) and, since then, the number and size of user communities appears to have increased as the costs of communication has decreased. This increase in prevalence and impact suggests a need to further investigate both how communities function, as well as their relationships with firms.

We expect that the effects of user communities on innovation, firms, industries, and society will continue to grow. The decreasing cost of information is allowing user communities to use modularity on increasingly complex projects (Altman et al. 2015). For example, open source principles have been utilized by user communities, combined with 3D printing technology, to make physical objects as complicated as cars (Norton and Dann 2011), houses (Wu et al. 2016), and even space ships (Aaronson 2012). Although we would not argue that firms and organizations will be completely replaced by user communities, it is certainly reasonable to consider the impact of OSS on proprietary software firms as a harbinger of what is to come for many companies in the physical manufacturing space. It has been posited that every small geographic area (*e.g.,* town or neighborhood) could have its own 3D printing setup that would allow locals to download plans from a user community and locally print everything from cutlery and furniture to cars and houses (Davis 2016). This would certainly have impacts on traditional manufacturing industries and supply chain and logistics operations as well. As is the case with software, many people will not

be willing to undertake the added efforts of this process, so a space for traditional firms will still exist. This process embodies the separation of the form and function of an artifact (Yoo 2013). This notion has been pithily captured in the statement "it's easier to ship recipes than cakes and biscuits",[28] but if this notion could be applied to all physical goods (or at least a vast majority of them), then it is clear there would be a fundamental shift in production and distribution models (Nagle 2018a).

Our understanding of how firms can work with communities is still developing. On one hand, user innovation communities represent an alternative model for innovation and for spurring entrepreneurship. This model is characterized by the free and transparent exchange of knowledge, providing a striking alternative to firms which traditionally operate through hierarchical and price mechanisms. On the other hand, firms have successfully "partnered" with numerous user communities by working within the structure of these communities. Such partnerships are distinct from the more contractual forms of partnerships that managements scholars are used to considering (*e.g.,* alliances, joint ventures), yet they work and bring unique benefits and the many informal dimensions may (or may not) mirror the informal aspects of contractual relationships. Our goal with this article was to discuss the relationship between user communities and firms and to help shine light on the many promising avenues for future research in the strategy domain.

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[28] This statement is often attributed to economist John Maynard Keynes, but there is limited evidence he actually originated it.

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