Research Policy xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

Selecting an open innovation community as an alliance partner: Looking for healthy communities and ecosystems

Maha Shaikh[a,*], Natalia Levina[b]

[a] Department of Digital Humanities, King's College London, United Kingdom
[b] Stern School of Business, New York University, United States

ARTICLE INFO

Keywords:
Strategic alliances
Partner selection
Open source community
Open innovation
Open ecosystem
Company engagement with open source
Company-community relationship

ABSTRACT

Organizations build strategic alliances with other firms with the intent of tapping into partners' resources and capturing long-term value from these relationships. Such partnerships are typically governed by contractual or equity arrangements with clear mutual obligations. More recently, however, organizations have begun to seek strategic partnerships with open innovation communities, which are novel digitally enabled forms of organizing, and where contractual commitments are not possible. Thus, selecting the right open innovation community as an alliance partner becomes a more complex decision. We follow how the organizational decision makers, in two technology firms that were pioneers of forming strategic alliances with open innovation communities, developed metrics around making such decisions. We build upon Shah and Swaminathan's (2008) contingency model of alliance partner selection and consider how it applies to the case of partnering with open innovation communities. This framework was useful in to frame our findings, yet our work recognizes and builds upon two key differences: 1) the evaluation metrics used in selecting an open innovation community were more focused on value creation than value capture; and 2) open ecosystem considerations, and not just partner-specific metrics, featured prominently in this type of alliance partner evaluation. We develop the notions of community and ecosystem health to refer to these new metrics.

"Here's a technology. How powerful is the community that's using this technology? How stable is that community? Do I want to invest my business in it?" (Red Hat CEO, James Whitehurst, 2013)[1] .

1. Introduction

Inter-organizational literature is rich in studies on how, and why, ties are built between organizations (Gulati and Gargiulo, 1999; Kenis and Knoke, 2002; Khanna and Rivkin, 2006), especially ties that enable digital innovation across an ecosystem (Helfat and Raubitschek, 2018; Nambisan et al., 2017). This body of work emphasizes how the desire to tap into resources more quickly than competition and innovate by combining diverse sources of expertise (Hoang and Rothaermel, 2005) compels organizations to look beyond their own boundaries (Lorenzoni and Lipparini, 1999; Parmigiani and Rivera-Santos, 2011).

However, whereas firms are increasingly engaging with external partners for innovation and efficiency, how organizational decision makers actually pick an alliance partner is not well understood. We know that organizations are likely to choose partners that they had prior relationships with, but we know far less about how organizational decision makers actually conduct a potential partner evaluation (Furlotti and Soda, 2019). Although selecting an alliance partner is not a frequent decision in organizational life, organizations nonetheless develop routines around such evaluations, which constitute their alliance management capability (Li and Rowley, 2002). However, these capabilities may not be directly relevant when organizations are choosing a non-traditional partner with whom they cannot sign a formal contract or negotiate an equity arrangement (Poppo and Zenger, 2002 Reuer and Africa, 2007; Ryall and Sampson, 2009). This is particularly true when new, digitally-enabled forms of organizing are involved, and when organizations seek to partner with open innovation communities (Boudreau and Lakhani, 2013; Dahlander and Magnusson, 2005; Stam, 2009; West and Lakhani, 2008; Boudreau and Lakhani 2009).

Today, companies and especially technology firms are increasingly embracing open innovation communities as part of their innovation strategy (Dahlander, 2007; Greenstein and Nagle, 2014;Dahlander and

* Corresponding author.
E-mail addresses: maha.shaikh@kcl.ac.uk (M. Shaikh), nlevina@stern.nyu.edu (N. Levina).

[1] Marks, J., and Micheli, M. 2013. "Open Source Tech Is Driving Big Changes in Government," in: *NextGov*. http://www.nextgov.com/emerging-tech/2013/04/open-source-tech-driving-big-changes-government/62839/

https://doi.org/10.1016/j.respol.2019.03.011
Received 9 December 2017; Received in revised form 9 March 2019; Accepted 13 March 2019

Gann 2010), and the decision of which communities to partner with is becoming more frequent. One notable aspect of the process of partnering with open innovation communities is that, often, one partner – the corporation – often starts working with the other partner – the community – without the other 'partner' becoming aware of it. As innovation communities use open processes and produce publicly accessible assets, such as code, designs, and artwork, etc., corporations seeking to work 'with them' can do so by 'lurking' on mailing lists, downloading non-copyrighted art work, and taking software without asking for permission (Dahlander, 2007; De Silva et al., 2018; Germonprez et al., 2017). These freely accessible resources may mislead decision makers, especially those new to the phenomenon, into thinking that they are not forming inter-organizational partnerships, but rather merely consuming goods within a public domain. Nevertheless, there is ample evidence that firms, which use these 'open' assets over the long-term, become strategically dependent on open innovation communities and face the same cooperation and coordination challenges, common to strategic alliances (Dahlander and Magnusson, 2008).

Research about the nature and implications of company engagement with open innovation communities (Afuah, 2017; Bogers et al., 2017; Levina and Fayard, 2017; West and Sims, 2017) has grown, yet the question of how organizational decision makers select an open innovation community as their alliance partner is still poorly understood. The value of engaging strategically with open innovation communities often does not materialize until later, meaning that companies have to evaluate potential for value creation (Rolland et al., 2019) and capture rather than the immediate payback. As a result, managers, who make decisions regarding open innovation engagements, face a great deal of ambiguity (Fayard et al., 2016;Afuah and Tucci 2013).This ambiguity is common to many forms of digital innovation, as the boundaries between innovation processes and outcomes are often blurred. This makes it necessary to evaluate not only the potential partner's current capabilities but also their ability to adjust to future evolving needs (Nambisan et al., 2017).

To investigate the question of how organizational decision makers select an open innovation community to partner with, we conducted interviews with managers, who were experienced in making such decisions, from two firms that have been on the forefront of building alliances with such communities for over two decades. Specifically, we looked at how those two firms selected which open source community to engage with. Open source communities are a subtype of open innovation communities that have a historical track record of over twenty years (von Hippel, 2001; von Hippel, 2005). Moreover, organizations tend to choose open source communities, often irrespective of which technological platform they are hosted on, whereas for the for newer forms of open innovation communities, such as those that produce art works or solve scientific problems, the choice of platform provider that "hosts" the community, often precedes the choice of the community itself. We adopted a Grounded Theory Method (GMT) (Charmaz, 2014; Glaser and Strauss, 1967) and collected data from open-ended interviews and archival documents. This data was collected to learn how managers that were faced with a choice of communities to engage with (i.e. the practice of open sourcing) made their decision. Our data collection involved questions to managers that probed their decision to open source a long time before engagement with open source communities was a widespread practice. Our findings revealed that, after a number of initial setbacks and surprises in the early years, the managers who led open source projects, were able to develop new approaches for choosing an open innovation community. We analyzed their setbacks and successes and developed a framework that shows how managers probe for a healthy community and a healthy ecosystem.

2. Background literature and theory

2.1. Partner selection in alliance building

While strategic alliance literature is rich and well established, its primary focus has been on commercial inter-firm relationships governed by contractual or equity arrangements. Given the novelty of digital organizing, it is less than surprising that this research has not focused on how organizations form alliances with open innovation communities. Notwithstanding this, these new types of external relations share some of the same aims as those that characterize commercially-governed strategic alliances. Kale and Singh's (2009) extensive review of the strategic alliance literature classifies the mechanisms of commercial governance and the aims of diverse inter-organizational relationships. Their writing distinguishes strategic alliances, from other types of interfirm relationships, through the nature of its long-term strategic scope, rather than through its governance mechanism (contract or equity). In particular, they term "non-traditional contractual partnerships" as alliances that include aims, such as conducting joint R &D and marketing activities, accessing mutually complementary assets and skills, and participating in joint standard setting. The open and user innovation literature shows that firms, which engage with open innovation communities over the long-term, typically share the very same aims (e.g., Afuah et al., 2018; Dahlander and Magnusson, 2008; von Hippel, 2005). Thus, whereas the strategic alliance literature does not discuss such arrangements directly, it may still offer fruitful insights into how companies may go about selecting a strategic partner, albeit with the caveat that it only reports on studies of partnerships that are governed by commercial terms.

Three main streams of research focus on partner selection in alliances (see Table 1). The first argues that alliance partners are largely chosen, based on one partner's ability to provide the resources that the other partner seeks at the time of the partnership's formation (Furlotti and Soda, 2019; Mitsuhashi and Greve, 2009). This very rich stream of research establishes that firms seek partners with both complementary resources (where differences in resources are seen as productive) and compatible resources (where similarity in resources makes collaboration among firms more feasible) (Mitsuhashi and Greve, 2009). More recent work adds nuance to this perspective by arguing that beyond the alliance's strategic goals, the needs of a specific task for which the

Table 1
Literature Streams on Partner Tie Formation in Strategic Alliances.

Streams	Focus	Sample papers
Resource complementarity, compatibility, and fit	This stream argues that alliance partners are selected based on matching task or project needs with the resources that alliance partners have (to address this need).	(Furlotti and Soda forthcoming; Kale and Singh, 2009; Li and Rowley, 2002; Mitsuhashi and Greve, 2009; Premkumar et al., 2005; Shah and Swaminathan, 2008; Zhiang et al., 2009)
Potential for productive partner co-evolution	This stream acknowledges the dynamics in alliance relationships and argues that partners may be chosen, based on their future potential, and may emerge or dissolve as the partners and the network around them evolve.	(Das and Teng, 2000; Doz, 1996; Koza and Lewin, 1998; Li and Rowley, 2002)
Social relations in an inter-organizational network	This stream sees contracts, both market and relational, as the basis of partner selection in alliances. Alliance ties are formed based on prior ties, common third parties, or specific structural positions in inter-organizational networks.	(Faems et al., 2008; de Figueiredo and Silverman, 2017; Furr and Shipilov, 2018; Gibbons and Henderson, 2012; Gulati 1995; Obstfeld, 2005; Reuer and Africa, 2007)

	Process manageability: Low (difficult)	Process manageability: High (easy)
Outcome interpretability: Low (difficult to interpret)	Most critical: *Trust*	Most critical: *Complementarity*
Outcome interpretability: High (easy to interpret)	Most critical: *Commitment*	Most critical: *Financial payoff*

Fig. 1. Contingency Model of Partner Selection and Attractiveness (Shah and Swaminathan, 2008).

alliance has been formed and the relative power associated with each partner's own resources shape alliance tie formation (Furlotti and Soda, 2019). The literature on corporate engagement with open innovation communities echoes this sentiment, that partnerships within such communities are often based on the complementarity and compatibility of the task-related resources that are involved in the relationship. Corporations often partner with communities, in order to innovate on specific tasks, by tapping into the resources that they are missing internally (Afuah and Tucci, 2012; Dahlander and Wallin, 2006; Felin and Zenger, 2014), but for which they have a relevant absorptive capacity (Lichtenthaler and Lichtenthaler, 2009), complementary IP (Lakhani and Lonstein, 2011), and/or access to markets (Vanhaverbeke et al., 2008). The literature argues that these complementary resources allow corporate partners to capture the value that is generated by their relationship with the community.

The second stream of literature embraces the importance of resource considerations in the choice of a strategic alliance partner but points out that such partnerships are built for the long-term and, hence, entail dealing with a significant amount of change and adjustment. This perspective highlights the importance of looking at the phenomenon dynamically and accounting for the alliance development processes (Das and Teng, 2000; Koza and Lewin, 1998). This perspective pays special attention to the co-evolution of the partner relationship, as partners learn more about each other, discover new sources of value, and develop capabilities specifically to address the other partner's needs (Koza and Lewin, 1998). Keeping an eye on long-term value creation – based not only on the current situation but also on the potential for resource development and relationship evolution – can become an important strategic consideration (Das and Teng, 2000). Moreover, researchers have found that past experience with a specific partner in other business relations (e.g., alliances formed for a different task), together with their willingness and ability to adjust to the focal firm's needs, are likely to lead to the same partner's being selected again for a new task (Li and Rowley, 2002). The focus on the alliance development process and relationship co-evolution is particularly likely to be relevant to our research context as engaging with a community for an innovation-related task is full of uncertainties, ambiguity, and turbulence (Felin and Zenger, 2014; Germonprez et al., 2017).

The third stream of research points out that new partnerships arise on the basis of historically-established, formal and informal social network ties. Specifically, organizations often partner when they: belong to a single legal entity, such as a parent company (Faems et al., 2008; Gulati, 1995; Reuer and Africa, 2007); are part of an inter-organizational business network with a common third party, who may serve as a broker; or occupy a particular structural position in an inter-organizational network (Furr and Shipilov, 2018; Obstfeld, 2005). This literature pays special attention to the social capital that accumulates in inter-organizational networks. It often refers to relational contracting (Baker et al., 2002) as a mechanism for preventing opportunistic behavior and ensuring long-term cooperation. Relational contracts in strategic alliances complement or even subsume formal contracts (Poppo and Zenger, 2002; Ryall and Sampson, 2009), which are hard to specify fully in long-term uncertain relationships. Relations in a business network help foster new ties through trust-building mechanisms, potential partners' global and local reputations, and their social network position (Carson et al., 2006). Given that corporations often engage with open innovation communities without a formal contract and rely heavily on building good relationships, the network perspective on alliance formation may be particularly relevant to us (Dahlander and Magnusson, 2008, 2005). Open innovation literature highlights the importance of relational governance over other types of governance (e.g., contracts, contests, employment) when engaging with an open innovation community as opposed to other forms of open innovation (Felin and Zenger, 2014). Moreover, strong network effects in digital goods markets (Eisenmann et al., 2009) further increase the importance of this perspective in our context.

While prior work has focused on analyzing archival data on historical alliance tie formation, recent work has pointed out the need to understand the evaluation criteria and processes that are actually used by organizational actors when selecting alliance partners (Furlotti and Soda, 2019; Shah and Swaminathan, 2008). Shah and Swaminathan's (2008) study proposes and tests a framework that identities the relative importance of four key categories of evaluation criteria: trust, commitment, complementarity, and financial payoff, in choosing a partner (see Fig. 1). They draw on organizational control theory (Ouchi, 1980; Ouchi, 1979) and propose that one of the four evaluation criteria is likely to dominate any final decision, depending on the nature of the task and process involved in the relationship. They identify two key variables that determine which evaluation criteria are most important in choosing an alliance partner: outcome interpretability, which refers "to the degree of difficulty associated with being able to interpret or understand with certainty the exact outcomes of a particular project," and process manageability, which refers to "the amount of communication required by partners for the effective coordination and control of alliance activities" (Shah and Swaminathan, 2008, p. 474, emphasis original). Ouchi's (1979, 1980) control theory argues that when outcome interpretability is low, a project owner has to rely more on process/behavioral rather than outcome controls. If process controls are also hard to establish, often due to the lack of the project owner's knowledge about the process, then one has to rely on "clan" controls – usually associated with common identity, reciprocity, mutual trust, and shared culture. Shah and Swaminathan (2008) argue that alliance partners are evaluated primarily based on their likelihood to fit a particular alliance control approach that is likely to govern the partnership. For example, financial payoffs are most important when planning to use outcome controls, while trust dominates the decision when planning to use clan control.

Delving further into this framework, Shan and Swaminathan (2008) pay special heed to evaluating the trust potential of the partner, arguing that it can be broken down into benevolence-based trust that focuses on a partner's good will and the lack of propensity to engage in opportunistic behavior and competence-based trust that focuses on the partner's consistent demonstration of credibility and expertise (p. 474).

While this pioneering work offers many useful insights, the overall stream of research on decision-making processes in partner selection is still in relative infancy, perhaps because it is very difficult to gather relevant data with real organizations. Shah and Swaminathan (2008) had to rely on MBA students analyzing hypothetical scenarios to test

their framework. Other researchers had to infer evaluation criteria that probably played into the partner choice by using archival data and comparing ties that were formed to those that could have been formed, but were not (Li and Rowley, 2002).

Trying to apply insights of Shah and Swaminathan's (2008) framework to the question of how companies choose which open innovation community to partner with presents many challenges. For one, companies can try to assess the financial payoff of the relationship by focusing on specific outputs produced by a community such as ideas, designs, and products. Those could be counted and measured, but they may not lead to financial payoffs given that these outputs are equally accessible to the firm's competitors and given that the long-term reliance on a volunteer community for such outcomes in the absence of any contractual obligations may be problematic (Dahlander and Magnusson, 2008; Germonprez et al., 2017). Similarly, one cannot force volunteer members to make a commitment to a corporate project. Community members could be recruited as employees, but this may be met with resistance from the community. Volunteers can also be encouraged to make further commitments if they identify with the firm (Spaeth et al., 2015), but a guaranteed commitment of volunteers is not possible. Complementarity, which in Shah and Swaminathan's (2008) framework refers to partners having a joint stake in maintaining a good public image with key external stakeholders such as customers, is also hard to assess. For example, public attitudes towards whether proprietary and open source software are complementary or competing change drastically over time (Dahlander and Wallin, 2006; Morgan and Finnegan, 2010). Finally, how do firms evaluate the potential for building trust with an open innovation community before they have had a chance to work with it? Unlike commercial alliances, if an open innovation community fails to cooperate well with a corporation, it may not suffer any reputation losses and indeed may even gain reputation in certain circles (O'Mahony and Bechky, 2008; Shah, 2006). The question of benevolence-based trust is particularly hard to assess due to the nature of organizing on digital platforms, where a corporate stakeholder may have no way of assessing offline identity of participants. This lack of verifiable identity may expose corporate partners to strategic risks if such anonymous participants are, for example, competitors.

2.2. Partner selection in corporate engagement with open innovation communities

Organizations may engage with open innovation communities, and particularly open source communities, for a variety of reasons. In the simplest case, they may use open source software in their daily operations for cost-saving reasons (Kwan and West, 2005). Increasingly, however, firms engage with open source communities to gain the strategic value that comes from co-developing software and services with them (Agerfalk and Fitzgerald, 2008; Dahlander and Magnusson, 2008; Kwan and West, 2005). Earlier literature has posited three types of benefits in such an engagement: 1) the cost saving that comes from using 'free' external code, documentation, and testing; 2) the innovation potential of co-developing products with a diverse community of contributors and, thus, increasing the speed of innovation; and 3) increasing the speed of software adoption by making it open, which deters competition and enables sales of complementary products and services through the ecosystem (Baldwin and von Hippel, 2011; Dahlander and Magnusson, 2008; Dedrick and West, 2007; Kapoor and Agarwal, 2019). However, the literature also suggests that significant strategic risks are involved in corporate engagement with open innovation communities. These risks stem from the co-dependency between the firm and the community, the loss of control over what is being developed, the need to protect company IP, and the reputational exposure (Baldwin and Clark, 2006; Dahlander and Magnusson, 2008; Stuermer et al., 2009).

Most work in the area of evaluation in open source software that is from a corporate standpoint addresses only the first goal of cost reduction by focusing on evaluating various aspects of the software code and accompanying documentation. In addition to evaluating which software features are supported (Gupta and Singla, 2012; Mijinyawa and Abdulwahab, 2014; Money et al., 2012), this research discusses the traditional measures of software quality (Fuggetta, 2003; Spinellis et al., 2009; Stamelos et al., 2002), maturity and reliability (Aberdour, 2007; Petrinja et al., 2009), and maintainability (Samoladas et al., 2004). The recommended assessments focus on both direct measures such as, the number of lines of code, availability of documentation, number of commits and bug reports, and quality of test plans, and indirect measures, such as the number of downloads, which is argued to be a good proxy for quality (see Vijaya et al., 2017 for a recent review). However, this literature also acknowledges that, in practice, formal evaluation criteria are rarely used, and that familiarity with the product often drives the selection (Torchiano and Morisio, 2004).

Apart from the open source literature focused on software evaluation, we have not found any literature that focuses on choosing which community has a good potential to serve as a corporate innovation partner – the second key goal of such relationships. Most studies focused either on a single community, working with a single corporation (e.g., Schlagwein and Bjørn-Andersen, 2014), or studied the experiences of various firms, where each worked with a specific open innovation community, and tried to unpack what happened once the relationship had already been established (Dahlander and Magnusson, 2005; Germonprez et al., 2017; Naparat et al., 2015). A significant body of literature focused on the factors that enabled the sustainability of open source communities and ecosystems (Crowston et al., 2006; Jansen, 2014); but, typically, this literature was not concerned with corporate engagement and took an 'inward' perspective.

Regarding the third key strategic value, the desire to speed up the adoption of new products and services using the model, discussion is also lacking into which community could help an organization to achieve this goal. An organization can capture value through such engagements by deterring competition and commercializing complementary products and services (Adner, 2006; Alexy and Reitzig, 2013; Dahlander and Magnusson, 2008; Zhu and Zhou, 2012). However, the community is often engaged with other for-profit firms, who potentially are competing with the focal firm in trying to capture the value created through an open ecosystem (Adner, 2006; Davis, 2016; Gulati and Gargiulo, 1999; Helfat and Raubitschek, 2018; Nambisan et al., 2017). Because most empirical studies of corporate engagement with open innovation consider one digital ecosystem at a time (e.g., Linux), the question of how the choice of a partner community influences a firm's engagement with a wider ecosystem has not been investigated.

Aside from suggesting a robust set of metrics for assessing software quality, the literature has generally remained silent on how corporations choose between alternative communities for long-term engagement. We focus our investigation on this important question: how do organizational decision makers select an open innovation community as their alliance partner?

3. Methodology

We chose a grounded theory-building approach (Charmaz, 2011; Glaser, 1987; Glaser and Strauss, 1967) for our study, as our goal is to develop a theoretical understanding of a relatively new and poorly theorized phenomenon. We embraced an abductive approach to grounded theorizing (Charmaz, 2011, 2014; Charmaz and Belgrave, 2015; Richardson and Kramer, 2006), which maintains that researchers always bring their prior knowledge and research interests into theorizing a phenomenon, and hence the theory that is developed, on the basis of this data, is not purely inductive in its nature (Urquhart and Fernandez, 2013).

3.1. Research sites

During our initial data collection, in early 2010, we became interested in exploring the broad issues associated with firm's engagements

with multiple open innovation communities. At that time, very few firms had any extensive experience with multiple open innovation communities, so it was a challenge to gain access to corporate decision makers, who had considered more than one open innovation community as a potential partner. It was important that we gained cooperation at the firm level, as opposed to just the individual decision makers within the firm, so that we could corroborate the results of our interviews with archival records and thereby reduce recall bias. We obtained access to a leading technology firm (Company A[2]) that was one of the pioneers of corporate engagement with open sourcing. We gained entry when a senior manager from the company expressed interest in participating in a research project on open source engagements, after attending the first author's presentation at a conference. While we were still collecting data from Company A, we decided to seek a second firm, with a rich open sourcing history, because we had exhausted the relevant interview subjects but had not yet reached theoretical saturation (Glaser and Strauss, 1967; Guest et al., 2006). We wanted to find firms with similar histories of open source engagements, in order to be able to make a more comparable decision-level analysis across both firms. We were able to negotiate access to Company B, after reviewing a mailing list of open source developers and inviting those with corporate email addresses to contact us.

Companies A and B were fairly similar in terms of size, global business model (MNCs), workforce composition, market position, and brand. They also had similar histories of engaging with multiple open source communities for more than a decade. Company A began its journey slightly earlier than Company B and had engaged with a greater number of communities, which resulted in its having experienced more "growing pains" as a pioneer. This experience also meant that Company A was able to show greater evolution in its thinking than Company B. In addition, Company A had been involved with a greater number of end-user focused applications, developed by open source communities. In our analysis, this meant that Company A paid more attention to the network effects associated with open source product ecosystems than Company B did.

There were no other notable differences revealed in our data between Companies A and B with regard to the research question we posed. Both firms engaged with close to 100 open source development projects and both stated publicly that they had contributed 1000+ employees to these communities. Both firms continued to use more traditional methods of in-house software development, alongside open source community engagement. Respondents from both firms reported similar reasons for engaging with communities; both firms sought a strategic first-mover advantage with a particular community and were exploring a new model of competition more broadly.

We reached theoretical saturation in our data collection after 39 interviews, across the two firms, and towards the end, our emergent theory began to explain the newly collected data quite well (Glaser and Strauss, 1967; Guest et al., 2006). To ensure that our findings were not specific only to large, leading technology firms, we interviewed two additional senior decision makers from smaller firms that had a history of repeated community selection decisions, because they focused their strategies on partnering with open source communities (Dahlander, 2007). While we focus our analysis and writing on the data collected from Companies A and B, the data from these new interviews reinforced our findings.

3.2. Interviews and documents

Whereas our data collection comprised a broad set of issues concerning corporate engagement with open innovation communities, in this paper we draw specifically on the data pertaining to how the community choice decision was made. This data came from two sources: 1) in-depth semi-structured interviews and 2) archival documents. Table 2 summarizes the data that were analyzed for this paper.

3.2.1. Interviews

In 2010 and 2011, we conducted 39 interviews with US- and European-based employees across both companies. Each interview lasted for at least an hour-and-a-half, and the interviews with the key informants, who had been with each company for many years and were leading open source engagement efforts, lasted as long as four-and-a-half hours. They were carried out in person (14) and over video-conferencing (30). They involved top and middle managers as well as software developers in open source projects (see Table 3).

This study began with exploratory questions about the company's engagement with open source communities. In early 2010, the literature on open source communities was quite large, but the new phenomenon of corporate engagement with open source was not well understood. Hence, the first author began with open-ended interviews, with employees from Company A, to learn about the goals, processes, and consequences involved in the firm's engagement with open source communities. In these initial interviews, the first author noticed that many interviewees complained about struggling with the question of which communities they should be engaged with, and which were not worth the effort. At the same time, the interviewees indicated that their own understanding of engaging with communities had evolved over time. The first author then revised the interview guide, to focus more on questions concerning community selection. As a result, the final interview guide explored questions about the nature of the company's engagement with open source communities, what attracted the company to the community, and how the experience of engagement with a given community had shaped the subsequent community selection and management decisions.

3.2.2. Archival documents

We collected both public documents from websites, blogs, and news articles and internal corporate documents, pertaining to each company's open source community engagements. The interviews' subjects frequently shared corporate, time-stamped documents with us, which helped to understand their interpretations of the past (Miller et al., 1997). Of particular value were the slide presentations and memos about open source adoption that had been sent out, over the years, to explain the decision-making process and rationale behind open source-related decisions to other stakeholders within the (same) company. At the time of active data collection (completed in 2011), we found 1095 publicly available documents for Company A, which were mostly technical in nature. Only 47 of them were relevant to the evaluation activities that were identified in the interviews. The same search for Company B resulted in 4230 documents, of which 4132 were related to technical issues, and 62 were relevant to our study themes. We also identified public websites for each firm that discussed the firm's open source engagement activities. The archival data provided a solid background context for making sense of each firm's overall goals and of the specific historical references that had been made by managers in the interviews.

3.3. Data analysis

Following GTM guidelines (Glaser, 1987; Glaser and Strauss, 1967), iterative data analysis took place during the period of intense data collection, which involved documenting any emergent themes in memos and using these themes to identify subsequent interview subjects, to modify subsequent interview questions, and to pursue new archival data. We relied on open coding and memoing as our key analytical tools (Charmaz, 2006; Rouse, 2016).

Our diverse data sources gave us both process and cross-sectional views of the phenomenon that we were studying.

We developed a cross-sectional perspective on the question, based on the information the interviewees shared about which evaluation

[2] Both company names are pseudonyms, used to protect the identities of the research site and the respondents.

Table 2
Data Used for Analysis.

Data Sources	Data Collected	Analytical Purpose
In-depth semi-structured interviews		
36 company employees (˜ 1-1.5 hours)	996 single-spaced pages of interview transcripts	Understanding construction of value of open source engagement
3 open source engagement leaders (˜ 4 hours)		Open source engagement history and management practices at each firm
		Differences in subjective judgements vs official statements
Archival documents		
Online company materials and reports	47 (Co A) + 62 (Co B) documents on open source engagement	Understanding company background with open source engagement, and media view
Public blogs and news clippings	21 public reports & numerous news articles	Detailed data on specific open source engagement projects (numbers, types, and durations)
Meeting minutes	36 meeting minutes	Comparison with subjective perceptions reported in interviews
Slide decks used to explain open source engagement to other stakeholders and gain their support	49 slide decks	Comparison between public vs internal justifications
		Evolution of open source engagement strategy, practices, and evaluation over time

Table 3
Interviews Conducted.

Interviewee's Role	Company A	Company B
Senior managers	2	3
Middle managers in technology, marketing, human resources, and strategy groups	15	10
Developers	5	4
Subtotal Company Interviews	**22**	**17**
Total	**39**	

criteria they used in evaluating communities, how these criteria matched their organizational goals, and how they compared to the criteria they were used to choose corporate partners. We developed a process perspective on our phenomena, based on a number of data sources. First, our interviews were conducted over a two-year period, during which corporate open sourcing was maturing as a practice. Second, Companies A and B started adopting open source at different times, with A demonstrating more mature practices. Third, when we asked our informants about how they chose between open source communities, they inevitably shared both what they were doing currently and how they had arrived at it; for example, by learning from their own past mistakes and by discovering new goals for such engagements. Finally, we had access to almost all company documents on how such decisions had been made over time, which showed us both the quantitative and qualitative evaluation criteria that had been institutionalized across the firm. For several key open source projects in each firm, we were able to document the evolution in the goals of such engagements, the evaluation criteria, and the new challenges in substantial detail. All these data sources allowed us to draw a distinction between the cases where the companies were deciding to fully with certain communities and where they were merely "probing", by engaging on a small scale, to help them to conduct a better evaluation.

We transcribed all the interviews and coded them using Atlas.ti content analysis software. The initial set of open codes reached 89 categories. Further discussion, between both researchers, helped refine the open codebook down to 61 first-order concepts, which were then used for the subsequent coding. Whereas the new first order concepts fit the data well and the memos revealed some novel insights, the relationship of the first order concepts to our research questions lacked parsimony (Walsh et al., 2015). To address this, we related our inductive findings to the extant literature on corporate open source engagements, software vendor evaluation, alliance partner selection, and ecosystems into our analysis of emergent themes to develop a clearer narrative (Charmaz, 2006; Glaser and Strauss, 1967).

As part of the process (Muller, 2014), we identified the following themes in our memos: 1) the distinct challenges faced by companies, when considering to engage with open innovation communities; 2) the nature and type of these challenges; 3) the evolving formalized and informal criteria used by managers to judge a particular community; 4) the changing objects of the evaluation (e.g., product, community, ecosystem); 5); the relationships of the evaluation criteria to value capture, trust, complementarity and commitment; and 6) the tension between judging an observable outcome and trying to control an uncertain process. These themes allowed us to generalize from our first-order concepts (e.g., "number of core developers who dropped out in protest at corporate's involvement in the community") to the second-order themes ("community orientation towards corporate engagements") and aggregate dimensions ("community friendliness to corporation") (following Corley and Gioia, 2004). Analyses of these helped us to uncover how decision-making had changed over time, from looking for open innovation communities as providers of specific products with certain features to looking for healthy communities and healthy ecosystems. In our final analysis, presented in Appendix A, we found that relating our findings to Shah and Swaminathan's (2008) work helped integrate our insights into a cohesive framework.

In the next section, we will focus on our cross-sectional findings, also noting how managers recognized that their ability to choose a community had shifted, from using quantitative evaluation criteria assessed at a distance to an experiential understanding of whether a community that they were experimenting with was a good long-term partner or could potentially be nurtured to become one. We will elaborate this process-focused perspective further in the discussion section.

4. Selecting an open source community as an alliance partner

Commercial alliance partnerships are common in software industry, so it is not surprising that managers in our study reported initially using the same approaches for the open source community selection process as they were used to using in selecting software vendors. However, they soon realized that the initial metrics did not work well in this new environment:

> "[Many managers] have grown up in a software industry that has been defined by vendors, defined by vendor relationships.… I think, that with open source you have to experience and do in order to be a credible participant and, you know, make [yourself] a credible commentator on it." (Senior Manager – Company B).

Below, we give an overview of how managers, who were focused on building long-term partnerships, engaged in a journey of learning how to make this new type of partner choice. Their approaches varied from project to project, as well as depending on their reflections on the lessons-learned from earlier projects. These included: 1) evaluating communities based on the value of the tangible outcomes they were

offering, 2) understanding which communities were viable and could be relied on long-term, 3) probing for which communities were friendly in partnering with corporations based on their ideology, processes, and governance; and 4) evaluating the health of an ecosystem that consisted of a variety of external parties who were involved with the community as users and contributors. Whereas our interviewees learned which evaluation metrics worked for which engagement goal, over time, our data does not suggest that decision makers needed to go through these phases of learning. Rather, each phase was associated with uncovering how a particular set of evaluation criteria, for a partner, achieved a certain goal, but not necessarily other goals.

4.1. Looking for valuable open products and services

Faced with a mandate from top management to partner with open source communities for strategic gain, decision makers on the ground struggled to relate what they were used to with corporate partner selection to this new directive. As a result, they focused on the most visible aspects of an open source community's outputs; such as, open source license type (more or less corporate friendly), software product features, quality of the code, documentation, and support services. Our companies had previously-developed templates and metrics for evaluating the choice of commercial vendors, to ensure financial payoffs from the relationships. In such alliances, there is an expectation of long-term dependence on the partner as software is embedded into the wider organizational processes and integrated with other technologies. This means that software upgrades, responsiveness to fixing bugs, and other support services were typically used as part of the Total Cost of Ownership (TCO) calculations. Decision makers at Companies A and B tried to adapt these calculations to the new environment.

However, they soon discovered challenges to adopting these metrics as support services, which were usually assured through contractual arrangements with the partner, were not guaranteed by the open source community. This meant that they had to choose between contracting with third-party vendors, who supported open source products (e.g., Red Hat for Linux); relying on the historical track record of a community in providing support services; or dedicating internal employees. Whereas it was relatively easy to obtain the cost of contracting for third party support services, these services were only available for a handful of widely-adopted open source products. For many other open source engagements, the firm needed to rely on the support provided either by the open source community or to invest in maintaining a proprietary version of the software. The latter option meant forgoing the benefits of openness and incurring the cost of re-integrating with the open version when the two diverged. The option of relying on the community for support, if such support was of high quality, was preferable by far. Thus, evaluating a community's track record of providing support services became a key part of our firms' assessment of their potential partner. Decision makers developed "metrics around sort of velocity of Q&A and velocity of resolution of issues." When this option failed, traditional project cost estimation tools were used to calculate the internal support costs, to be included into the Total Cost of Ownership calculation. Table 4 summarizes the metrics our companies' decision makers used to select communities, based on the costs and benefits of the products and services that they offered.

4.2. Looking for a viable community

As Companies A and B experimented with the new open source model, they began to appreciate the innovativeness and quality of some of the products that came from the diversity, transparency, and open processes of the communities:

> "I believe that what makes [open source] special is what I call the copy modify, share cycle [of code development]. … This type of innovation might be better referred to as 'diversity,' because that is really what the great thing that you are getting is – the ability to follow lots of bets at once" (Manager – Company B).

Moreover, and to their surprise, the companies' customers held open source-based development in high regard and started pushing A and B towards offering more of such products and services. As a result, in some areas, our firms moved from simply experimenting with this new model to adopting it as part of their strategic market offerings. This in turn meant that the companies that we studied, and their customers, needed to be able to rely on the community to keep innovating and supporting the product over the long-term.

Defining a community that corporate stakeholders could rely on, over time, was not easy, as there were no readily available measures. Outcome-focused measures (from Table 4) were useful indicators of a community's output to date, but not a guarantee of continuing innovation and quality. Thus, some forward-looking managers started to develop new metrics that moved beyond the cost-benefit analysis of products and services and towards assessing a community's viability:

> "How many people are in the community, how many people contribute, how often do they release, how many bugs they have on a given release? How many days does it typically take for a bug to be resolved on the community, how has it grown or shrunk overtime? … And those are the things that you evaluate to begin with and then monitor overtime to understand the viability of the [open source] project." (Manager – Company A).

A focus on viability meant paying attention to a community's evolution and momentum over time. It meant looking for signs that the community was growing both in terms of product output and in the size and diversity of its developer base. Managers discovered that information, by gathering open project metrics, which were readily available for many large open source projects through their version control software, which at the time was SourceForge (and more recently has become GitHub). The development mailing list provided managers with details about the key developers, who were making substantial changes to the code. The vibrancy of the developer base was associated with a healthy amount of participant turnover and an opportunity for new members to rise in influence, to become part of the core group. As a community grew, it was important that its members took on different roles, not only by contributing new code but also by improving the product, reporting bugs, building new releases, and providing support. Informants in both companies noted that, although they could gather a number of quantitative measures concerning community viability, it was also useful for them to probe the community through some peripheral participation, in order to get a qualitative sense for its vibrancy. Table 5 summarizes the metrics used in evaluating community viability.

4.3. Probing for a collaboration partner friendly to corporations

As Companies A and B deepened their reliance on open source software, they increasingly encountered open source products that did not fully address their (or their customers') needs. It was becoming less and less appealing to them to solve this challenge by creating a propriety version of the software – decoupled from the open source versions, as nobody wanted to forgo the advantages of innovation and quality that the open source communities provided. This meant that companies had to find ways of collaborating with communities so as to entice them to accommodate company-specific needs. There were no readily-available a priori indicators of whether a given community would support a company's agenda. Given no possibility of contracting with a community, to support their corporate needs, our firms began to probe for open source communities where their influence would be accepted, and perhaps even embraced, and where community work practices were accessible to external parties.

Whereas before, decision makers were evaluating products and services first, now they were willing to give up the current fit between

Table 4
Evaluating Community's Product and Services.

2nd order theme	1st order concept
Product features	- Fit with corporate needs
Software quality	- Community size as proxy for testing (many developers 'eyeballing' the code)
	- Number of downloads by users (indirect measure of software approval)
	- Number and variety of email threads interrogating issues with the code
Documentation availability	- Availability of wiki HOW TO pages
	- Accessible FAQ pages
	- Level of detail of documentation
	- Speed of updating documentation
Corporate-friendly license type	- Reciprocity level demanded by the license
	- Possibility to dual license the software
Track record of community-based support	- Average velocity of Q&A
	- Average time for issue resolution
3rd party support costs	- Costs of contracting with 3rd parties for support services (only available for popular open source products)
Internal support costs	- Personnel cost of providing support services
	- Costs of maintaining multiple versions and reintegrating repeatedly

Table 5
Evaluating a Community's Viability.

2nd order theme	1st order concept
Vibrancy of the developer base	Number of active contributors
	Growth of active contributors
	Renewal of the core contributor group
	Turnover of participants
Growth of the code base	Lines of code
	Number of subsystems
Attention paid to software quality improvements	Number of bug reports
	Number of upgrade patches made available
	Number of testers (members eyeballing code)
	Number of responses to questions

what communities were offering and what they needed, and instead consider whether "the direction of the community [was] in line with the direction of the given [internal] product team long term" (Manager, Company A). If the directions were aligned, they started asking "which communities are open to corporate influence and work in a way that allows corporations to build productive relationships with them" (Manager, Company A). Communities that were averse to corporate involvement, because of ideological reasons, simply resisted requests from corporate employees, or anybody for that matter, who was not part of the core group of developers.

A bigger issue arose when corporate development teams wanted to influence the core of the open software. The core source code was the crown jewel, carefully guarded by the community and it was not easy to influence. Companies were faced with the dilemma of needing to choose a community before they could fully assess whether their influence over the core product would be accepted. When we pushed our informants to articulate what had helped them to make an engagement decision in such circumstances, they inevitably directed their responses to the governance form of the community. They were looking for communication, role, and authority structures that mirrored the corporate world. Some communities had more obvious authority structures, which made it easier for firms to distinguish who the influencers were. Other communities were more democratic. Managers argued that, "You need some sort of executive decision-making capacity within the open community" (Manager, Company B). They could then reach out to this authority, in the hopes of receiving a definitive response. As one manager observed, too much democracy in the community could lead to corporate participants saying, "The hell with you, I've got to serve my customers" (Manager, Company B). Table 6 summarizes how managers evaluated a community's friendliness towards companies.

Whereas, on occasion, our companies found viable, corporation-friendly communities to work with, more often than not they needed to engage with the communities first and to probe to see whether they could influence the development of communication processes and governance mechanisms, which would result in making them good collaboration partners. Such influence was achieved by building reputation with community members, by contributing developers, code, hardware, and other resources. Companies A and B were not just evaluating from a distance, but were actually nurturing, through direct engagement, what they referred to as "healthy communities" – viable, corporate-friendly communities that consistently produced high-quality, innovative products and services:

Table 6
Evaluating Community's Friendliness to Corporations.

2nd order theme	1st order concept
Community's orientation towards corporate engagements	Evidence that past decisions were based on ideological grounds rather than pragmatic ones
	Number of core developers who dropped out in protest against corporate involvement in the community
	Stated attitudes of community leaders towards corporate involvement
	The degree of community leaders' ideological influence over others (e.g., their ability to overcome resistance if they are supportive of corporations)
Accessible communication processes	Access to developer mailing lists
	Consistency with which the community maintains online FAQs and transparent documentation through wikis, blogs, and community sites
	Direct access to specific developers
Clear governance structures within the community	Clear and visible order of trusted maintainers of code versions
	Clear delineation of responsibilities among developers for specific modules and tasks
	Ability to discern leaders
Willingness to accommodate corporate interests	Searchable history of past community decisions on product versions (related to any company)
	Revealed desire by community to tap into a company's customer base for testers and users
	Community's willingness to commit to agreed-upon release dates

> "From my experience with open source, clearly the biggest benefits are when you have really established a healthy community, whether that's a community of committers but also a community of people who are using and providing you feedback about the software. You need that kind of cycle, that whole loop to be really a well-oiled machine, and in the best projects that is absolutely what happens, you get lots of feedback and you get lots of people's eyes on the code to improve the quality and that just continues to cycle forward as the software matures" (Developer, Company B).

4.4. Probing for a healthy ecosystem

As we compared company documents from the early days of open source engagements to a more recent time, we noted a significant shift in the criteria used for partner evaluation, in both firms. Whereas the focus was initially on evaluating open products and services as well as community health, later documents paid more attention to corporate players, including competitors, strategic partners, and clients, involved with the community. Because overcoming internal resistance to working with open source communities was "really, really difficult," the involvement of other reputable firms with the community was very helpful (Manager, Company B). Sometimes, our companies waited for others to demonstrate that a given community was worth pursuing:

> "You were seeing all the companies waiting for the first one [corporate adopter] and then the second one to make the move, which were the bold ones. 'Oh my God! They are doing that move! What happens to them? They are collapsing, or they will collapse in two years maybe.' And you wait and when it works [you adopt]." (Manager, Company B).

Often, customers were embracing the open source model faster than internal groups within Companies A and B, and they were gravitating towards open source communities that had already developed a reputation among a wide set of corporations.

> "Now we also are using S-drive adoption, and it's so early days, but what we found last year is that as soon as customers found out that the code was based on open source technology, they trusted it much more because they didn't have to overcome a mental gap of like hey, what does (Company B) know about managing Linux. It's no longer they trusted our offer, they're trusting the community's offer." (Manager, Company B).

As pioneers themselves, Companies A and B were often the ones recruiting other corporations to supporting communities that they were involved in:

"We're saying, let's go out and find a community that has a lot of corporations affiliated with it and saying, in order for us to make our own projects sustainable as a community project, not just as our project, we need to get other companies backing it." (Manager, Company A).

As managers shifted their attention to the involvement of other firms, they developed quantitative metrics to measure that involvement. For example, a quick check of the mailing lists showed developer affiliation, which allowed our evaluators to estimate the number and types of firms involved with the community. Company members also attended offline hackathons and open source conferences, where they recognized other reputable firms that were involved. They also evaluated the nature of the donated resources, including paid employees working in the community, code donations, support services provided, and sales of the paid version of the software. As one manager noted:

> "There needs to be money flowing through the system sustainably for people, for customers, to feel comfortable investing in the product and for developers to choose to spend their time honing their skills on it and for entrepreneurs to stake their businesses on it. So, the economy around a platform is important" (Manager, Company A).

At the same time, managers started evaluating the technical features of the software code that would enable more firms to join as users and contributors. They looked at the concentration of APIs, the modularity of the code, and the number and range of complementary products being offered. They paid special attention to a community's attempts to make their code reusable by diverse participants and not specific to any one contributor's requirements.

A company's ability to judge how the network of relationships around an open source community – an ecosystem – functioned was by no means immediate. It took some years of probing and learning before our companies were able to gauge which other commercial firms were involved in the ecosystem and how they were influencing critical decisions. Companies, interested in joining an ecosystem, would attend company-held or sponsored hackathon events, where a mix of stakeholders generally joined in, to network and learn about new projects being established in the ecosystem. Networking, discussions, and information sharing between all levels of stakeholders helped to establish a discourse about which company held greater influence and why.

Surprising to us, our companies, that were likely to be quite influential in the ecosystems they chose to join, insisted on the importance of a strong and meritocratic governance of the ecosystem involved, rather than just exerting unilateral influence. They noted the importance of an ecosystem "not being driven by one company's agenda" (Strategist, Company B). Their evaluation criteria shifted, from the potential to build a promising proprietary relationship with a healthy community to the appeal of participating in a healthy ecosystem. The latter refers to a sustainable, expanding set of diverse participants with a stake in the success of a given open source product, governed by transparent and meritocratic means. As one of the informants noted:

> "I'd really just look at numbers of commercial customers who are paying for services that are around the platform… And numbers of employees at companies whose job it is to provide that support. I really think a lot of Project X's success has come from having a range of small firms that were going to take risks and be innovative…And you know it's not the best written open source management platform, but I think it's one of the very healthiest communities and one of the most sustainable projects by virtue of the way that the commercial process works around the platform" (Strategist, Company B).

Table 7 summarizes the indicators used for judging ecosystem health.

5. Discussion and implications

Our investigations of how decision makers evaluated which open source communities to partner with revealed that they underwent a journey during which their understanding of what evaluation criteria were the most relevant evolved. Our analysis showed that the main task underlying these partnerships, i.e., to gain strategic benefits by incorporating open source software products into their commercial offerings, did not change over time. However, our informants realized that performing this task well involved achieving a number of different goals along the way, each requiring different evaluation criteria. Their learning journey allowed us to theorize how different evaluation criteria fit the different and evolving goals of corporate partnerships with open source communities.

Our inductive findings resonate with Shah and Swaminathan's (2008) alliance partner selection framework. Similar to these researchers, we found that the most relevant criterion in partner selection varied depending on the situation. Moreover, we found that key evaluation criteria that they identified, namely, trust, commitment, reputational complementarity, and financial payoff, could be usefully adapted to interpret our findings. For example, we saw that evaluating software products and services focused on financial payoffs, whereas, evaluating community viability was about assuring the community's long-term commitment to developing the product. Similarly, evaluating

Table 7
Evaluating Ecosystem's Health.

2nd order theme	1st order concept
Strength of ecosystem partners	- Number of partners
	- Types of partners
	- Reputation of partners
	- Degree of commitment to the ecosystem
Level of support by partners	- Code and hardware donated
	- Paid employees working on the project
Commercial acceptance of the chosen license regime	- The use of the same license regime used for distributing the core code in distributing products developed by ecosystem partners
	- Number of dual licensing schemes set up by partners (presumably to avoid using the license regime of the core code, or to change the business model)
Modularity of the platform	- Number of APIs
	- Number of modules shared and reused by partners
	- Number of modules developed by partners
Ability to reuse components and complementary products	- Level of reciprocity needed by the license
	- Generic versus specific nature of components
	- Degree of component embeddedness in partner's products
	- Number of competing versions (forks) of the product
Ecosystem governance structures	- Type of leadership model in the ecosystem
	- Reliance on open source foundations in governance
	- Clear rules and regulations for negotiations
	- Historical basis for making decisions (merit or influence-based)
Powerful influencers in the ecosystem	- Number of influential partners
	- Number of smaller players in the ecosystem and their alignment with influential partners
	- Relationship between influential partners and the focal firm
	- Merits for gaining influence

the community's friendliness towards corporations was about establishing whether the community could be trusted. Part of the evaluation of the ecosystem's health was about judging whether the ecosystem's participants had complementary market reputations which would create joint stakes in ecosystem's success. At the same time, our decision makers were also assessing other aspects of the ecosystem's health and not just the specific partner – community. In line with Shah and Swaminathan (2008), we also saw that all four criteria, whether assessed quantitatively or qualitatively, were used in every decision; however, some criteria were more dominant than others depending on certain contingencies.

One significant difference between Shah and Swaminathan's (2008) framework and our findings is that the evaluation criteria used in choosing an open source community, by an large, were not applied to the value expected from the relationship between a community and the corporation[3] but rather to the community in general. For example, the community viability metric was not focused on assuring the community's commitment to the company, but rather on the community members' general commitment to developing and maintaining an innovative, high quality software product. Similarly, the corporation friendliness metric was focused on making sure that any corporation could trust the community as a collaborator and not just our companies. The two components of trust that were identified by Shah and Swaminathan (2008), goodwill and competence, were indeed very relevant, but they were assessed in general terms, as goodwill towards any corporate involvement and the overall community's process towards maturity. The ecosystem's health was not squarely focused on assessing complementarity between the ecosystem's participants' market reputations and the firm's own, but rather it concerned the complementarity among the market reputations of a large number of organizations that had a stake in the success of the community and its products.

Our companies' focus on evaluating the healthiness of a potential partner as an entity rather than on the specific proprietary benefits that the relationship would accumulate is consistent with the notion that in open innovation partnerships both private and public goods are created (von Hippel and von Krogh, 2003). While our firms started with a traditional focus on creating proprietary gains from an alliance relationship by "taking" public goods and assessing how those goods benefited them, they quickly evolved their evaluation metrics towards overall community and ecosystem health. This is consistent with the notion that firms that engage with open innovation communities are participating in the creation of public goods that should, over time, give them some proprietary benefits, but not necessarily immediately (Baldwin and von Hippel, 2011; von Hippel and von Krogh, 2003; West and Gallagher, 2006). Our companies quickly shifted their evaluation focus from proprietary value capture in a relationship towards broader value creation in an open innovation ecosystem (Lichtenthaler, 2011).

Shah and Swaminathan (2008) drew on organizational control theory to argue that the dominant evaluation criteria is dictated by the nature of the alliance project/task. They argued that an alliance's task characteristics, of outcome interpretability and process manageability, defined the contingencies. If we were to interpret their framework literarily, we would be forced to classify long-term strategic corporate partnerships with open source communities as having low outcome interpretability and low process manageability. Because the very nature of engaging with open innovation communities means that corporations cannot fully control the outcomes or processes in such communities. As a result, if they follow the original framework, evaluators should focus primarily on those communities that exhibit reputational complementarity in the marketplace – communities that are part of well-established ecosystems with non-competing participants.

This is not what we found, however. Instead, our data suggests that the decision makers did not perceive the outcome and process characteristics as exogenous attributes of the alliance task. Rather they shaped the alliance task and the evaluation criteria proactively, as they were learning how to better interpret what value they were getting from the relationship and how to manage processes with the community. Thus, they either focused on more interpretable outcomes, such as the costs and benefits of adopting a particular software product or the less interpretable outcomes, such as the degree to which future products and services had the potential to meet corporate needs (as part of community friendliness metric). Similarly, for process manageability, company decision makers made tough bets on whether they wanted to get involved with poorly managed communities and invest heavily into co-creating good process(es).

[3] For example, Shah and Swaminathan (2008) use relationship-specific measures such as "*How critical is it that ABC acts in good faith in pursuing mutual partner interests in this alliance?*" (p. 494)

Finally, the new alliance tie between the company and a community was not formed by selecting the right partner for a particular alliance goal, a priori, but rather the firms probed the communities through small scale engagements to see if there was potential for a productive alliance partnership co-evolution, over time. Our informants clearly stated that it was impossible to understand the potential for value creation of any given open source community, without participating in it. Similarly, it was difficult to impossible to assess the ecosystem's health without both being part of the ecosystem and trying to shape it. Consistent with the partner-co-evolution perspective of alliance formation (Das and Teng, 2000), our companies were willing to take risks, in forging new partnerships, without being able to perform a detailed evaluation of all criteria beforehand. This was because they were willing to nurture open source communities and to invest resources into the ecosystem's health in order to make these partnerships more attractive over time.

We integrated these insights into Fig. 2, and we now propose a theoretical framework for evaluating an open innovation community as an alliance partner based on alliance goals.

6. Implications for research

As strategic corporate partnerships with digital open innovation communities become more popular (Bogers et al., 2017; Greenstein and Nagle, 2014), the number of communities that corporations can choose to partner with also grows. Yet, innovation management literature, to date, has not investigated how organizational decision makers select those alliance partners. We investigated this question and propose a number of insights for the literatures on strategic alliance and the digitization of innovation.

6.1. Implications for strategic alliance literature

Historically, strategic alliance literature has focused on organizations forming alliances with other organizations, using commercial arrangements such as signing contracts and investing equity (Kale and Singh, 2009). We have argued that in its goals and nature a long-term strategic relationship with an open innovation community often serves the same purposes (e.g., conducting joint R&D or co-promoting a product) as a commercial strategic alliance. Moreover, recent empirical studies of software alliances (Han et al., 2012) treat the relationships formed among commercial firms through their joint participation with the same open innovation community as examples of strategic alliances even though such alliances do not rely on traditional commercial arrangements. Our paper also proposed treating a long-term strategic partnership with an open innovation community as a new digitally-enabled form of strategic alliance relationship; however, we also suggested that such a relationship could be formed between a firm and an open innovation community and not just among firms. Our work demonstrates how insights from the traditional strategic alliance literature (e.g., Shah and Swaminathan's 2008 framework) are relevant to studying these emerging relationships in the digital age and we encourage others to build on traditional strategic alliances literature as they study digitally-enabled forms of alliances.

The strategic alliance literature has also discussed tie formation among partners in an alliance (as summarized in Table 1); yet, to our surprise, the actual decision-making process of organizational actors in choosing alliance partners has not been studied to the same depth. Shah and Swaminathan (2008) developed a theoretical framework about which factors should matter in choosing alliance partners depending on the relationship goal, they did not have access to data from organizational decision makers actually making such decisions. Nor did their work focus on the dynamic evolution of goals in the relationships. We contribute to the literature on alliance tie formation in three key ways: 1) by conducting a rare empirical study of decision makers evaluating alliance partner choices within their organizational context; 2) by extending the alliance partnership formation literature to include new types of digitally-enabled innovation partnerships and by showing how the framework changes as a result; and 3) by highlighting the role of value creation over value capture in digital ecosystems. We will now elaborate on these three factors.

First, our empirical investigation of the criteria that organizational decision makers used in evaluating alliance partners revealed that they did not see the alliance task as having exogenous outcomes and process characteristics, as proposed by Shah and Swaminathan (2008). Instead they saw it as actively shaping whether they wanted to focus alliance goals on more or less interpretable outcomes and whether they wanted to invest in costly process management or not. This happened within the context of the same overall alliance task (of developing commercial offerings based on open source products), suggesting that the recent literature, which highlights the role of the alliance task in alliance formation (Furlotti and Soda, 2019), does not fully explain the variations in our findings. Shah and Swaminathan (2008) used specific examples from the airline industry, such as evaluating a partner for a code-sharing alliance versus evaluating an equipment supplier, which implied certain outcome and process characteristics. However, in practice, it is possible that these aspects of the relationship are associated with the strategic goals of the alliance and not with the objective task features. Future strategic alliance partner choice studies could help shed light on whether this finding is relevant only to digital innovation, which typically exhibits ambiguous goals (e.g., Fayard et al., 2016) and processes (Gulati et al., 2012), or is more common to all types of alliances than previously assumed.

Second, our study extends Shah and Swaminathan's (2008) framework to include new types of digitally-enabled alliances that are not

	Process manageability: ***desirable***	**Process manageability:** ***not needed***
Outcome Interpretability: ***not needed***	*Alliance Goal*: Co-develop with community *Key Criteria*: Trust in the community's willingness and process competence in collaborating with corporations *Evaluation Metric*: **Community's Friendliness to Corporations**	*Alliance Goal*: Supply and demand-side network effects in the ecosystem *Key Criteria*: Strength and complementarity of interests among ecosystem partners in the long-term success of the community *Evaluation Metric*: **Ecosystem Health**
Outcome interpretability: ***desirable***	*Alliance Goal*: Rely on the product long-term *Key Criteria*: Contributors' commitment to keep producing the product *Evaluation Metric*: **Community Viability**	*Alliance Goal*: Adopt the product *Key Criteria*: Financial payoff from using the product *Evaluation Metric*: **Firm's Value from Community's Product and Services**

Fig. 2. Model of Selecting Open Innovation Community as Firm's Alliance Partner.

governed by traditional commercial arrangements and that involve co-creation (Barrett et al., 2015) of public and private goods (von Hippel and von Krogh, 2003). It was somewhat surprising to us that in spite of the differences in the governance regimes, the key criteria, identified in the framework, and their relationship to process and outcome characteristics remained relevant to our context. At the same time, the actual translation of these criteria to the new phenomenon was far from direct. Indeed, criteria such as a partner's commitment to the relationship seem hard to apply when a community of volunteers on a digital platform is often anonymous and has no formal obligation towards the corporation. Moreover, the community may be ideologically opposed to partnering with firms but not reveal its opposition until the corporate engagement is already under way. We found that each of the four original criteria took on a new form within this context, but, most importantly, that the evaluation was less focused on proprietary value capture in the relationship and much more focused on public value creation. The strategic alliance literature has consistently acknowledged the importance of such value co-creating alliances (Barrett et al., 2015) in the last twenty years (Doz, 1996), but has not explicitly incorporated focus on value creation (vs. capture) as an alliance partner selection consideration. This can be largely explained by the rather economics-driven slant of the literature. Yet, modern economics also accounts for the possibility of private benefit through public good creation (Brandenburger and Stuart, 1996). It is not entirely surprising, therefore, that decision makers are paying more attention to public benefit than they were previously given credit for. Future studies should consider the degree to which value creation, versus capture, enters corporate decision makers' evaluation criteria, in alliance partner selection outside the context of open source alliances. Certainly, if scarce, high-quality human resources are only willing to participate in healthy communities (Crowston et al., 2006), it is likely that a consideration of the community and ecosystem's health will continue to play an important role in partner evaluations, beyond proprietary gains.

Third, whereas strategic alliances literature offers plenty of evidence that new alliance ties are likely to form on the basis of social relations in inter-organizational networks (see Table 1), Shah and Swaminathan (2008) do not discuss inter-organizational network considerations directly in their framework. Our findings show that these considerations were in the forefront of decision makers' minds when choosing open innovation communities. This is not surprising given the importance of network effects in digital ecosystems, both on the supply and the demand side (e.g., Eisenmann et al., 2009; Wareham et al., 2014). Digital goods with high up-front fixed costs and strong network effects (Furr and Shipilov, 2018; Helfat and Raubitschek, 2018) create synergies among diverse participants that go beyond aligned reputational stakes discussed in Shah & Swaminathan's (2008) framework. Digital ecosystems bring together parties with directly conflicting goals (e.g., buyers and sellers or direct competitors), who, nevertheless, have a common stake in maintaining a healthy ecosystem.

6.2. Implications for research on digitally-enabled open innovation communities

There are a number of research implications for the literature on corporate engagement with open innovation communities. First, within open source literature, most studies that considered issues pertaining to community health took the perspective of a developer deciding which community to join. There is some degree of overlap between our findings, related to community health, and this earlier work. For example, researchers explored which quantitative factors could be used by a developer to indicate whether a given open source community was worth joining, such as bug-fixing time, popularity of the project, and community size (Crowston et al., 2006; Izquierdo-Cortazar et al., 2010; Raja and Tretter, 2012; Soto and Ciolkowski, 2009). Some studies in this stream suggested that not only should measurable markers be considered but also "social health" features, such as knowing where a new developer can get help (Head, 2016). Possibly the most significant work in this domain focused on operationalizing ecosystem health by drawing on four previously published studies, all of which relied on archival data from code repositories (Jansen, 2014). This body of work proposed a number of metrics that were consistent with those used by our informants, such as metrics focused on product and support services (Table 4), numbers and type of ecosystem participants and product modularity (see Table 7). Whereas this work went into great depth about measuring elements that can be scraped from code repositories, it did not focus on the strategic factors involved in having a corporate entity engage with the community (e.g., corporate friendliness or license type), nor did it consider factors that are not easily assessed from code repositories, such as the presence of democratic governance. Researchers who have discussed community governance (Laffan, 2012) did consider whether important decisions were accessible to a volunteer participant but not necessarily a corporate entity. Overall, our work builds on this stream of research and adds a number of considerations, which are important to corporations and which may not be directly relevant to volunteer developers. Most importantly, we show how various measures of a community or ecosystem's health relate to the diverse goals of engaging with open innovation communities.

Second, and as already noted, both the community and ecosystem health assessments focused more on value creation than value capture. This is in contrast to previous studies of corporate engagement in open innovation that focused more on value capture. These studies foregrounded such characteristics as the focal firm having influence over ecosystem decisions (Morgan et al., 2013) and gaining proprietary benefits from being in the same ecosystem as market leaders (Adner, 2006; Han et al., 2012). Our findings partially align with these earlier studies, in that our decision makers also paid attention to the resources invested by others into the ecosystem. However, when it came to the issue of influence, our companies soon realized that limiting the amount of influence any one player could exert (including their own) was crucial to sustaining a healthy ecosystem. Moreover, making sure that product architecture was built for a wide reuse by potential future ecosystem participants (possibly competitors) meant focusing on value creation again at the expense of value capture, at least in the short-term. This finding is consistent with much of the writing on value creation versus value capture in open ecosystems (e.g., Eisenmann et al., 2009; Gawer, 2014; Wareham et al., 2014). Our work contributes by pointing out specific quantitative and qualitative criteria that firms can use to measure an ecosystem's potential for value creation and value capture. While our participants did not formally optimize tradeoffs between these various criteria, future research could focus on doing this modeling, for example, analyzing the tradeoffs between numbers of generic versus partner-controlled components in the ecosystem.

Speaking more broadly to the literature on digitally-enabled (Rolland et al., 2019) open innovation beyond open source (e.g., Felin and Zenger, 2014), we also find that this work rarely asks the question of how to find the right partner. Theoretically, this literature could suggest matching community expertise with the company's innovation task (e.g., Arazy et al., 2016; Felin and Zenger, 2014; Lifshitz-Assaf, 2018). Today, however, more and more open innovation communities offer similar professional expertise, such as Kaggle, TopCoder, and Upwork for data science; NineSigma and Innocentive for scientific innovation, and DesignCrowd and 99Designs for graphic design (e.g., Boudreau and Lakhani, 2013; Kaganer et al., 2013). This means that firms must move beyond choosing a partner based on whether its expertise fits their problem, towards evaluating community, and perhaps ecosystem, health. Future research could dig deeper into how these concepts and their measures varied across communities, engaged in different types of work.

6.3. Limitations

Our work has three main limitations. First, as there was no readily available framework within open innovation literature that was focused on selecting an open innovation community, we appropriated a model

from alliance literature. We adapted a model by Shah and Swaminathan (2008) to fit our purpose. While the correspondence between our inductive findings and deductive framework was not perfect, building on earlier scholarship let us to interpret our findings in a more parsimonious and integrated fashion. At the same time, the differences between the framework, which was developed for commercial alliances, and our data helped us to understand which aspects of the partner evaluation process were specific to this new setting and which were general to both old and new phenomena.

Second, our study focused on open source community partnerships, which – following a well-established research tradition (e.g., Chesbrough, 2007, 2003; Shah, 2006; von Hippel and von Krogh, 2003; West and Gallagher, 2006) – we treated as examples of open innovation communities. More empirical investigations need to be conducted to asses which aspects of our findings are idiosyncratic to the open source context and which ones are generalizable beyond it to other innovation communities.

Finally, we focused on the multi-decade journey of two pioneer companies in forming alliances with open source communities. It is possible that some of the goals and evaluation criteria used in forming these alliances are no longer relevant, whereas others have become dominant across the industry. Moreover, it is possible that smaller or younger firms may have slightly different sets of concerns about entering an alliance partnership with an open innovation community than those that our companies had, necessitating further investigation.

7. Conclusion

Our work addresses the important question of how organizational decision makers select which open innovation communities to engage with as an alliance partner. While in the early days of company engagement with digitally-enabled open innovation communities there was little choice of communities of partner with, today, more and more open innovation communities are receptive to corporate engagement. The blurring of the boundaries between internal and external work, as well as between innovation processes and innovation outcomes, that is associated with digital innovation (Nambisan et al., 2017) makes it particularly difficult to make such evaluations. Moreover, the openness of participation and anonymity and fluidity of participants, which often characterizes digitally-enabled innovation communities (Faraj et al., 2011), causes great difficulty when it comes to applying the traditional criteria of trustworthiness and competence in choosing an alliance partner. Finally, digitally-enabled open communities are constantly evolving (Gulati et al., 2012) which makes partnering with them a moving target and necessitates a great degree of flexibility in adjusting organizational goals in such partnerships.

The pioneer firms that we studied addressed these challenges head on. They learned from their experiences with digital innovation and developed new criteria for choosing open innovation communities as their alliance partners. Their ability to define and collect these criteria benefited from the transparency, often associated with processes and outcomes on digital innovation platforms (Nambisan et al., 2017). In the beginning, this same transparency prompted decision makers to focus on the most visible aspects of innovation – the value of tangible products and services produced by the community. Eventually, however, our industry pioneers learned to move away from easily observable characteristics and to develop more nuanced ones. They also learned to give up an outdated mindset that was primarily focused on private value capture from specific outcomes, to instead embrace new categories of value that were more appropriate for the goal of partnering with the community in order to co-create public goods. Developing these measures inadvertently helped the companies' managers to understand the actual value proposition, of participating in an open digital ecosystem, better.

Acknowledgements

The authors thank the special issue editor, Satish Nambisan, and the two anonymous reviewers, for their excellent feedback and suggestions during the review process. They also received very valuable comments on earlier versions of this paper from the seminar participants at the Information Systems and Innovation Group of the London School of Economics and at the strategy brownbag series at NYU Stern School of Business.

Appendix A

Relating our data to Shah and Swaminathan (2008) criteria

Shah and Swaminathan's Definitions	Data Quotation	Our contextualizing notes
Trust Partner's goodwill and avoidance of opportunism, and confidence in partner's ability to perform alliance task	*It pretty much comes down to what our customers want and what solution they are most comfortable with and again the total cost of ownership. Do we see the expertise to administer one of those solutions and is one community more competent than the other than another and that's probably the one that we are going to be more comfortable with*	Trust as evident from a sense of competence and expertise of the open source partner.
	You know, the traditional models have been used in companies were very clunky, and nobody likes to use them because it seems like all contribution and no report but they found that with this open source approach, you know, that they were getting expertise coming in, they were getting better quality solutions.	Competence-based trust and reliance on open source community code offerings.
	First of all what comes are the synergies. You always have to look at the evolution of any bit of code. As in the last five years, if your answer is yes then, is the code you want supported by many others and that are leading … for what you need. This is where the community are important. These communities also hopefully make sure if individual and also other companies involved and so you will see that there will be more parties having similar concerns and similar difficulties as you are not the only corporate partner. In many cases someone has to start stepping in first. When you have the technologies and you want to hire people, so it is good that there is a community and any key contributor is a potential employee or any company there is a potential partner. All these aspects are important. Actually, it's not just pieces of software but that they are sustained by the community – which is alive.	Trust built by collective contributions and signals of expertise. This fragment of interview data also resonates with commitment ideas – but we note a gentle building up of goodwill based trust through communal and collective contributions.
	We needed to have a trustworthy, credible proven technology. So we worked with an open source application. All that innovation was already done, it was out there and product development was much faster because we adopted that as the basis for our management aegis.	Signal of expert software and clear capability offered by a good open source product.

Complementarity Reputational complementarity among partners' market reputations creating joint stakes around image with the customer	*In fact the patch tells you something else far more interesting which is it is a vote for a feature where instead of somebody saying I would love such and such, they have actually put some effort in and done it, so you have shown them by expending some time, reputational capital, something that is important to them. So in open source this is how you look for things, you look for the things that have cost people time and money, so and you wait in favor of those.*	Reputation here is seen more as a signal from the community which is interesting – but not as a PR appeal by the alliance-seeking company.
	Now we also are using S-drive adoption and it's so early days but what we found last year is that as soon as customers found out that the code was based on open source technology, they trusted it much more because they didn't have to overcome a mental gap of like hey, what does (company X) know about managing Linux. It's no longer they trusted our offer, they're trusting the community's offer.	This section of data clearly signifies trust, yet the main argument being made here is how customers recognized the value of open source and the company in question felt that making more of their engagement with open source would help attract more customers.
Commitment Partner's explicit or implicit pledge to make a tangible contribution to the relationship	*One thing, we sponsor those communities in some way or another for example, we donate most of the hardware for their infrastructure. We sponsored different events like, Apache or even smaller community advance…so we did involve both with money and with contributions.*	Commitment through contribution: contribution to the product directly but it signals commitment to the larger ecosystem – thus attracting more partners.
	Talk about how they are moving towards a more organized development model, which … by all means continues to encourage the contributions from the industry at large, but, at the same time, keeps things more on track in terms of here, we are moving to this goal and the next goal and it's not as patchy as it has been in the past. So, I do see the overall maturity of open source as it gets better and better to meet enterprise needs. I can see that improve. Also another part that helps there is, when you have these projects and, again, the more visibility they get, the more they are able to solve enterprise customer needs, the more that people from the community themselves will be able to contribute content.	Ecosystem level commitment is crucial for sustainability of the community.
	Certainly the viability of the community. How stable is the software? How viable is the community around it? Are they fixing bugs? Looking at the list to see, are people responsive to problems or bugs getting fixed. Is the community committed to supporting it? That's one of the big ones. It is possible to sub contract to smaller companies for support for this.	Commitment needs from the community and looking at the community level rather than larger ecosystem. This aligns with product related issues as a signal of health.
	What appeals to me, I think, is mainly two things. The fact that you are working with open standards as well. But the fact that you are working with an array of people. You've identified some common problems and then you are working within an array of people not within your own little, you know, company. The fact that you are bringing all these different people from all these different areas gives you the feeling that you are ultimately building something that is most acceptable to the widest array of end users, because you started with such a wide base of people feeding into the requirements. And, also, along with that, theoretically, you should get better coverage in terms of requirements, but also a sort of chair view of what's happening and what's the right direction to take on different topics. You can work solo on anything, really, but doing it as a group, you are going to bring in the group dynamic which causes more ideas to be brought in typically… humans just have to work better that way and be more successful, when the group dynamic is allowed to exist.	This was a response to our question of why this company chooses to work with open source communities.
	What you are talking about is really how do you encourage more collaboration and more development or participation I should say, all on these open source projects where maybe you are leaving it, but you really want it to sustain and you want to get as many folks interested as possible. We have different incentives for doing that. It's more of the focus to try and figure out, how do you promote, reuse and encourage people to participate and behave in this kind of more of an open source development methodology.	This quotation is coded with commitment. It is also suggestive of ecosystem values.
Financial payoff Tangible sources of value including reduction in costs, increase in profit, access to new markets, etc.	*Well, for the company involved it is driven by a project that you feel can help you do a better job with cheaper, faster, higher quality, if you use open source software, so that happens quite a bit and it can mimic systems inside of our company.*	Replies often to the question of how the manager chose the open source project to work with. Financial payoff recognized in the form of more efficient and cheaper software
	We just got lucky that those things came together … I can still remember some of the discussions we had at executive levels at (our company). Were you guys on drugs? What do you want to do? It was a pretty radical… essentially we are commoditizing. The pitch to our business partners was luck. We all want to work together to solve customers' problems. As a group, we've got limited amount of capital to invest. It's the nature of the business, right? How are we going to invest to best meet our customers' needs? We can all choose to write the same thing over and over and over again. Whether that's ten million dollars a year, we can all choose to spend ten million dollars a year to do the same thing repetitively to really give value to our customers or, we can choose to collaborate and with our contributors spend ten million dollars once and then use all the capital that's left, and individually invest in value on top of that and choose to compete.	This was a reply to the question of why they moved into open source when there was no clear business model. Ecosystem value is evident here as is the idea that value creation and value capture are both layered in theory and practice. Companies are able to create some value together while holding competitive value creation separate.
	The open source market started with only basic and very infrastructural requirements and then we added services and more value added services and more and more and more and we are on top of different layers and we are now offering very high quality and high level layers of services. But at each layer, you were seeing all the companies waiting for the first one and then the second one to make the move, which were the bold	This interviewee explained that the initial move into using and working with open source communities involved the bold first movers – value creation and capture were both hazy with regard to open source. Once the ecosystem began to grow then more companies jumped in to reap different forms of value.

ones, oh my god, they are doing that move. What happens to them? They are collapsing and they will collapse in two years maybe? And you wait and when it works, okay, it works. I read in some magazine that they were making a lot of money thanks to that. I have some pressure from my CEO to cut my expenses. I could do that and so then, when you have examples and you are under pressures, you slowly begin thinking that you could do that too. But you wait, always for someone to do it first. The first one usually is really a bold one.

References

Aberdour, M., 2007. Achieving Quality in Open Source Software. IEEE Software, pp. 58–64 (January/February).

Adner, R., 2006. "Match Your Innovation Strategy to Your Innovation Ecosystem,". Harvard business review (84:4), pp. 98.

Afuah, A., 2017. "Crowdsourcing: a primer and research framework,". In: Afuah, A., Tucci, C.L., Viscusi, G. (Eds.), Creating and Capturing Value Through Crowdsourcing. Oxford University Press.

Afuah, A., Tucci, C.L., 2012. "Crowdsourcing as a Solution to Distant search,". Acad. Manag. Rev. 37:3, 355–375.

Afuah, A., Tucci, C.L., 2013. "Value capture and crowdsourcing,". Acad. Manag. Rev. 38:3, 457–460.

Afuah, A., Tucci, C.L., Viscusi, G., 2018. Creating and Capturing Value Through Crowdsourcing. Oxford University Press, Oxford.

Agerfalk, P., Fitzgerald, B., 2008. "Outsourcing to an unknown workforce: exploring opensourcing as a global sourcing strategy,". MIS Q. 32:2, 385–400.

Alexy, O., Reitzig, M., 2013. "Private–Collective innovation, competition, and firms' counterintuitive appropriation strategies,". Res. Policy 42:4, 895–913.

Arazy, O., Daxenberger, J., Lifshitz-Assaf, H., Nov, O., Gurevych, I., 2016. "Turbulent stability of emergent roles: the dualistic nature of self-organizing knowledge coproduction,". Inf. Syst. Res. 27:4, 792–812.

Baker, G., Gibbons, R., Murphy, K.J., 2002. "Relational contracts and the theory of the firm*,". Q. J. Econ. 117:1, 39–84.

Baldwin, C.Y., Clark, K.B., 2006. "The architecture of participation: does code architecture mitigate free riding in the open source development model?,". Manage. Sci. 52:7, 1116–1127.

Baldwin, C., von Hippel, E., 2011. "Modeling a paradigm shift: from producer innovation to user and open collaborative innovation,". Organ. Sci. 22:6, 1399–1417.

Barrett, M., Davidson, E., Prabhu, J., Vargo, S.L., 2015. "Service innovation in the digital age: key contributions and future directions,". MIS Q. 39:1, 135–154.

Bogers, M., Zobel, A.-K., Afuah, A., Almirall, E., Brunswicker, S., Dahlander, L., Frederiksen, L., Gawer, A., Gruber, M., Haefliger, S., Hagedoorn, J., Hilgers, D., Laursen, K., Magnusson, M.G., Majchrzak, A., McCarthy, I.P., Moeslein, K.M., Nambisan, S., Piller, F.T., Radziwon, A., Rossi-Lamastra, C., Sims, J., Ter Wal, A.L.J., 2017. "The open innovation research landscape: established perspectives and emerging themes across different levels of analysis,". Ind. Innov. 24:1, 8–40.

Boudreau, K.J., Lakhani, K.R., 2009. "How to manage outside innovation,". MIT Sloan Manag. Rev. 50:4, 69–76.

Boudreau, K.J., Lakhani, K.R., 2013. "Using the Crowd as an Innovation Partner,". Harv. Bus. Rev. 91:4, 60–68.

Brandenburger, A.M., Stuart Jr, H.W., 1996. "Value-Based business strategy,". J. Econ. Manag. Strategy 5:1, 5–24.

Carson, S.J., Madhok, A., Wu, T., 2006. "Uncertainty, Opportunism, and Governance: The Effects of Volatility and Ambiguity on Formal and Relational Contracting,". Acad. Manag. J. 49:5, 1058–1077.

Charmaz, K., 2006. Constructing Grounded Theory: a Practical Guide Through Qualitative Analysis. Sage, London.

Charmaz, K., 2011. "Grounded theory methods in social justice research,". In: Denzin, N.K., Lincoln, Y.S. (Eds.), The Sage Handbook of Qualitative Research. Sage, Thousand Oaks, pp. 359–380.

Charmaz, K., 2014. Constructing Grounded Theory. SAGE., London.

Charmaz, K., Belgrave, L.L. (Eds.), 2015. Grounded Theory. John Wiley & Sons, London.

Chesbrough, H.W., 2003. "Open innovation: how companies actually do it,". Harv. Bus. Rev. 81:7, 12–14.

Chesbrough, H., 2007. "Open innovation: a new paradigm for understanding industrial innovation,". In: Chesbrough, H., Vanhaverbeke, W., West, J. (Eds.), Open Innovation: Researching a New Paradigm. Oxford University Press, Oxford.

Corley, K.G., Gioia, D.A., 2004. "Identity ambiguity and change in the wake of a corporate spin-off,". Adm. Sci. Q. 49:2, 173–208.

Crowston, K., Howison, J., Annabi, H., 2006. "Information systems success in free and open source software development: theory and measures,". Softw. Process. Improv. Pract. 11:2, 123–148.

Dahlander, L., 2007. "Penguin in a newsuit: a tale of how de novo entrants emerged to harness free and open source software communities,". Ind. Corp. Chang. 16:5, 913–943.

Dahlander, L., Gann, D.M., 2010. "How open is innovation?,". Res. Policy 39:6, 699–709.

Dahlander, L., Magnusson, M.G., 2005. "Relationships between open source software companies and communities: observations from nordic firms,". Res. Policy 34, 481–493.

Dahlander, L., Magnusson, M., 2008. "How do firms make use of open source communities?,". Long Range Plann. 41:6, 629–649.

Dahlander, L., Wallin, M.W., 2006. "A man on the inside: unlocking communities as complementary assets,". Res. Policy 35, 1243–1259.

Das, T.K., Teng, B.-S., 2000. "A resource-based theory of strategic alliances,". J. Manage. 26:1, 31–61.

Davis, J.P., 2016. "The group dynamics of interorganizational relationships: collaborating with multiple partners in innovation ecosystems,". Adm. Sci. Q. 61:4, 621–661.

de Figueiredo, John M., Silverman, Brian S., 2017. "On the genesis of interfirm relational contracts,". Strategy Sci. 2:4, 234–245.

De Silva, M., Howells, J., Meyer, M., 2018. "Innovation intermediaries and collaboration: knowledge–based practices and internal value creation,". Res. Policy 47:1, 70–87.

Dedrick, J., West, J., 2007. "Movement ideology vs. user pragmatism in the organizational adoption of open source software,". In: Kraemer, K.L., Elliott, M. (Eds.), Computerization Movements and Technology Diffusion, from Mainframes to Ubiquitous Computing. Medford, Information Today. Information Today, Medford, NJ.

Doz, Y.L., 1996. "The evolution of cooperation in strategic alliances: initial conditions or learning processes?,". Strat. Manage. J. 17:S1, 55–83.

Eisenmann, T.R., Parker, G., Van Alstyne, M.W., 2009. In: Platforms, Markets, Innovation, A.Gawer (Eds.), "Opening Platforms: How, When and Why?,". Edward Elgar, Cheltenham, UK, pp. 131–162.

Faems, D., Janssens, M., Madhok, A., Looy, B.V., 2008. "Toward an integrative perspective on alliance governance: connecting contract design, trust dynamics, and contract application,". Acad. Manag. J. 51:6, 1053–1078.

Faraj, S., Jarvenpaa, S.L., Majchrzak, A., 2011. "Knowledge collaboration in online communities,". Organ. Sci. 22:5, 1224–1239.

Fayard, A.-L., Gkeredakis, E., Levina, N., 2016. "Framing innovation opportunities while staying committed to an organizational epistemic stance,". Inf. Syst. Res. 27:2, 302–323.

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

Fuggetta, A., 2003. "Open source software—an evaluation,". J. Syst. Softw. 66:1, 77–90.

Furlotti, M., Soda, G., 2019. "Fit for the task: complementarity, asymmetry, and partner selection in alliances,". forthcoming. Organ. Sci.(0:0) p. null.

Furr, N., Shipilov, A., 2018. "Building the right ecosystem for innovation,". MIT Sloan Manag. Rev. 59:4, 59–64.

Gawer, A., 2014. "Bridging differing perspectives on technological platforms: toward an integrative framework,". Res. Policy 43:7, 1239–1249.

Germonprez, M., Kendall, J.E., Kendall, K.E., Mathiassen, L., Young, B., Warner, B., 2017. "A theory of responsive design: a field study of corporate engagement with open source communities,". Inf. Syst. Res. 28:1, 64–83.

Gibbons, R., Henderson, R., 2012. "Relational Contracts and Organizational Capabilities,". Organ. Sci. 23:5, 1350–1364.

Glaser, B.G., 1987. Theoretical Sensitivity: Advances in the Methodology of Grounded Theory. Sociology Press, Mill Valley, California.

Glaser, B.G., Strauss, A., 1967. The Discovery of Grounded Theory: Strategies for Qualitative Research. Aldine, Chicago.

Greenstein, S., Nagle, F., 2014. "Digital dark matter and the economic contribution of apache,". Res. Policy 43:4, 623–631.

Guest, G., Bunce, A., Johnson, L., 2006. "How many interviews are enough?: an experiment with data saturation and variability,". Field methods 18:1, 59–82.

Gulati, R., 1995. "Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances,". Acad. Manag. J. 38:1, 85–112.

Gulati, R., Gargiulo, M., 1999. Where do interorganizational networks come from? Am. J. Sociol. 104:5, 1439–1493.

Gulati, R., Puranam, P., Tushman, M., 2012. "Meta-Organization design: rethinking design in Interorganizational and community contexts,". Strat. Manag. J. 33:6, 571–586.

Gupta, A., Singla, R.K., 2012. "Quantitative and qualitative evaluation of F/Oss volunteer participation in defect management,". Int. J. Software Eng. Appl. (IJSEA) 3:2, 71–85.

Han, K., Oh, W., Im, K.S., Chang, R.M., Oh, H., Pinsonneault, A., 2012. "Value cocreation and wealth spillover in open innovation alliances,". MIS Q. 36:1, 291–325.

Head, A., 2016. "Social health cues developers use when choosing open source packages,". Proceedings of the 2016 24th ACM SIGSOFT International Symposium on Foundations of Software Engineering. ACM, Seattle, WA, USA, pp. 1133–1135.

Helfat, C.E., Raubitschek, R.S., 2018. "Dynamic and integrative capabilities for profiting from innovation in digital platform-based ecosystems,". Res. Policy 47:8, 1391–1399.

Hoang, H., Rothaermel, F.T., 2005. "The effect of general and partner-specific alliance experience on joint R&D project performance,". Acad. Manag. J. 48:2, 332–345.

Izquierdo-Cortazar, D., Gonzalez-Barahona, J.M., Duenas, S., Robles, G., 2010. "Towards automated quality models for software development communities: the qualoss and flossmetrics case,". Quality of Information and Communications Technology (Quatic), 2010 Seventh International Conference on the: IEEE. pp. 364–369.

Jansen, S., 2014. "Measuring the Health of Open Source Software Ecosystems: Beyond the Scope of Project Health,". Inf. Softw. Technol. 56:11, 1508–1519.

Kaganer, E., Carmel, E., Hirscheim, R., Olsen, T., 2013. "Managing the Human Cloud,". MIT Sloan Manag. Rev. 54:2, 23–32.

Kale, P., Singh, H., 2009. "Managing Strategic Alliances: What Do We Know Now, and Where Do We Go from Here?,". Acad. Manag. Perspect. 23:3, 45–62.

Kapoor, R., Agarwal, S., 2019. "Sustaining superior performance in business ecosystems: evidence from application software developers in the ios and android smartphone ecosystems,". forthcoming. Organ. Sci. 0:0 p. null.

Kenis, P., Knoke, D., 2002. "How organizational field networks shape interorganizational tie-formation rates,". Acad. Manag. Rev. 27:2, 275–293.

Khanna, T., Rivkin, J.W., 2006. "Interorganizational ties and business group boundaries: evidence from an emerging economy,". Organ. Sci. 17:3, 333–352.
Koza, M.P., Lewin, A.Y., 1998. "The Co-Evolution of Strategic Alliances,". Organ. Sci. 9:3, 255–264.
Kwan, S.K., West, J., 2005. A Conceptual Model for Enterprise Adoption of Open Source Software. The standards edge: Open season 51. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.11.11.93.8832&rep=rep8831&type=pdf.
Laffan, L., 2012. "A New Way of Measuring Openness: The Open Governance Index,". Technol. Innov. Manag. Rev. 2:1.
Lakhani, K., Lonstein, E., 2011. "Innocentive. Com," Harvard Business Case (Harvard Business School General Management Unit Case No. 612-026).
Levina, N., Fayard, A.-L., 2017. "Tapping into diversity through Open innovation platforms: the emergence of boundary-spanning practices,". In: Afuah, A., Tucci, C.L., Viscusi, G. (Eds.), Creating and Capturing Value Through Crowdsourcing. Oxford University Press, Oxford.
Li, S.X., Rowley, T.J., 2002. "Inertia and Evaluation Mechanisms in Interorganizational Partner Selection: Syndicate Formation among U.S. Investment Banks,". Acad. Manag. J. 45:6, 1104–1119.
Lichtenthaler, U., 2011. "Open Innovation: Past Research, Current Debates, and Future Directions,". Acad. Manag. Perspect. 25:1, 75–93.
Lichtenthaler, U., Lichtenthaler, E., 2009. "A capability-based framework for open innovation: complementing absorptive capacity,". J. Manag. Stud. 46:8, 1315–1338.
Lifshitz-Assaf, H., 2018. "Dismantling knowledge boundaries at NASA: from problem solvers to solution seekers,". Adm. Sci. Q.
Lorenzoni, G., Lipparini, A., 1999. "The leveraging of interfirm relationships as a distinctive organizational capability: a longitudinal study". Strat. Manag. J. 20:4, 317–338.
Mijinyawa, M.K., Abdulwahab, L., 2014. "An extended framework for evaluation of open source software adoption in small businesses,". Res. J. Inf. Technol. 6:4, 248–269.
Miller, C.C., Cardinal, L.B., Glick, W.H., 1997. "Retrospective reports in organizational research: a reexamination of recent evidence,". Acad. Manag. J. 40:1, 189–204.
Mitsuhashi, H., Greve, H.R., 2009. "A matching theory of alliance formation and organizational success: complementarity and compatibility,". Acad. Manag. J. 52:5, 975–995.
Money, L.P., Praseetha, S., Mohankumar, D., 2012. "Open source software: quality benefits, evaluation criteria and adoption methodologies,". J. Comput. Modell. 2:3, 1–16.
Morgan, L., Finnegan, P., 2010. "Open Innovation in Secondary Software Firms: An Exploration of Managers' Perceptions of Open Source Software,". SIGMIS Database 41:1, 76–95.
Morgan, L., Feller, J., Finnegan, P., 2013. "Exploring value networks: theorising the creation and capture of value with open source software,". Eur. J. Inf. Syst. 22:5, 569–588.
Muller, M., 2014. "Curiosity, creativity, and surprise as analytic tools: grounded theory method,". In: Olson, J.S., Kellogg, W.A. (Eds.), Ways of Knowing in Hci. Springer New York, New York, NY, pp. 25–48.
Nambisan, S., Lyytinen, K., Majchrzak, A., Song, M., 2017. "Digital innovation management: reinventing innovation management research in a digital world,". MIS Q. 41:1, 223–238.
Naparat, D., Finnegan, P., Cahalane, M., 2015. "Healthy community and healthy commons:'Opensourcing'as a sustainable model of software production,". Australas. J. Inf. Syst. 19.
O'Mahony, S., Bechky, B., 2008. "Boundary organizations: enabling collaboration among unexpected allies,". Adm. Sci. Q. 53, 422–459.
Obstfeld, D., 2005. "Social networks, the tertius iungens orientation, and involvement in innovation,". Adm. Sci. Q. 50:1, 100–130.
Ouchi, W.G., 1979. "A conceptual framework for the design of organizational control mechanisms,". Manage. Sci. 25:9, 833–848.
Ouchi, W., 1980. "Markets, bureaucracies and clans,". Adm. Sci. Q. 25, 120–142.
Parmigiani, A., Rivera-Santos, M., 2011. "Clearing a path through the forest: a meta-review of interorganizational relationships,". J. Manag. 37:4, 1108–1136.
Petrinja, E., Nambakam, R., Sillitti, A., 2009. "Introducing the opensource maturity model,". Proceedings of the 2009 ICSE Workshop on Emerging Trends in Free/Libre/Open Source Software Research and Development 37–41.
Poppo, L., Zenger, L., Laura, P., Todd, Z., 2002. "Do Formal Contracts and Relational Governance Function as Substitutes or Complements?,". Strat. Manag. J. s, 707–725.
Premkumar, G., Ramamurthy, K., Saunders, C.S., 2005. "Information processing view of organizations: an exploratory examination of fit in the context of interorganizational relationships,". J. Manag. Inf. Syst. 22:1, 257–294.
Raja, U., Tretter, M.J., 2012. "Defining and evaluating a measure of open source project survivability,". IEEE Trans. Softw. Eng. 38:1, 163–174.
Reuer, J.J., Africa, A., 2007. "Strategic alliance contracts: dimensions and determinants of contractual complexity,". Strat. Manag. J. 28:3, 313–330.
Richardson, R., Kramer, E.H., 2006. "Abduction as the type of inference that characterizes the development of a grounded theory,". Qual. Res. 6:4, 497–513.
Rolland, K.H., Mathiassen, L., Rai, A., 2019. "Managing digital platforms in user organizations: the interactions between digital options and digital debt,". forthcoming. Inf. Syst. Res.
Rouse, E.D., 2016. "Beginning's end: how founders psychologically disengage from their organizations,". Acad. Manag. J. 59:5, 1605–1629.
Ryall, M.D., Sampson, R.C., 2009. "Formal Contracts in the Presence of Relational Enforcement Mechanisms: Evidence from Technology Development Projects,". Manage. Sci. 55:6, 906–925.
Samoladas, I., Stamelos, I., Angelis, L., Oikonomou, A., 2004. "Open source software development should strive for even greater code maintainability,". Commun. ACM 47:10, 83–87.
Schlagwein, D., Bjørn-Andersen, N., 2014. "Organizational learning with crowdsourcing: the revelatory case of lego,". J. Assoc. Inf. Syst. 15:11, 754–778.
Shah, S.K., 2006. "Motivation, governance, and the viability of hybrid forms in open source software development,". Manag. Sci. 52:7, 1000–1014.
Shah, R.H., Swaminathan, V., 2008. "Factors influencing partner selection in strategic alliances: the moderating role of alliance context,". Strat. Manag. J. 29:5, 471–494.
Soto, M., Ciolkowski, M., 2009. "The qualoss open source assessment model measuring the performance of open source communities,". Proceedings of the 2009 3rd International Symposium on Empirical Software Engineering and Measurement: IEEE Computer Society. pp. 498–501.
Spaeth, S., von Krogh, G., He, F., 2015. "Research note—perceived firm attributes and intrinsic motivation in sponsored open source software projects,". Inf. Syst. Res. 26:1, 224–237.
Spinellis, D., Gousios, G., Karakoidas, V., Louridas, P., Adams, P.J., Samoladas, I., Stamelos, I., 2009. "Evaluating the quality of open source software,". Electron. Notes Theor. Comput. Sci. 233:0, 5–28.
Stam, W., 2009. "When does community participation enhance the performance of open source software companies?,". Res. Policy 38, 1288–1299.
Stamelos, I., Angelis, L., Oikonomou, A., Bleris, G.L., 2002. "Code quality analysis in open-source software development,". Inf. Syst. J. 12:1, 43–60.
Stuermer, M., Spaeth, S., Von Krogh, G., 2009. "Extending private-collective innovation: a case study,". R&D Manag. 39:2, 170–191.
Torchiano, M., Morisio, M., 2004. "Overlooked aspects of cots-based development,". IEEE Softw. 21:2, 88–93.
Urquhart, C., Fernandez, W., 2013. "Using grounded theory method in information systems: the researcher as blank slate and other myths,". J. Inf. Technol. 28:3, 224–236.
Vanhaverbeke, W., Van de Vrande, V., Chesbrough, H., 2008. "Understanding the Advantages of Open Innovation Practices in Corporate Venturing in Terms of Real Options,". Creat. Innov. Manag. 17:4, 251–258.
Vijaya, P., Chander, S., Raju, G., 2017. "Usqo-Foss quality model: utilization based software quality observatory for evaluation of free and open source software,". FREE AND OPEN SOURCE SOFTWARE CONFERENCE (FOSSC-17).
von Hippel, E., 2001. "Innovation by user communities: learning from open-source software,". MIT Sloan Manag. Rev. 42:4, 82–86.
von Hippel, E., 2005. "Open source software projects as "user innovation networks,". In: Feller, J., Fitzgerald, B., Hissam, S., Lakhani, K.R. (Eds.), Perspectives on Free and Open Source Software. MIT Press, Cambridge, MA, pp. 267–278.
von Hippel, E., von Krogh, G., 2003. "Open source software and the "Private-Collective" innovation model: issues for organization science,". Organ. Sci. 14:2, 209–223.
Walsh, I., Holton, J.A., Bailyn, L., Fernandez, W., Levina, N., Glaser, B., 2015. "What grounded theory is… a critically reflective conversation among scholars,". Organ. Res. Methods 18:4, 581–599.
Wareham, J., Fox, P.B., Giner, C., Lluís, J., 2014. "Technology ecosystem governance,". Organ. Sci. 25:4, 1195–1215.
West, J., Gallagher, S., 2006. "Challenges of open innovation: the paradox of firm investment in open-source software,". R&D Manag. 36:3, 319–331.
West, Joel, Lakhani, L., 2008. 'Getting Clear About the Role of Communities in Open Innovation'. Ind. Innov. 15, 223–231.
West, J., Sims, J., 2017. "How firms leverage crowds and communities for open innovation,". In: Afuah, A., Tucci, C.L., Viscusi, G. (Eds.), Creating and Capturing Value Through Crowdsourcing. Oxford University Press, Oxford.
Zhiang, L., Haibin, Y., Bindu, A., 2009. "Alliance partners and firm performance: resource complementarity and status association,". Strateg. Manage. J. 30:9, 921–940.
Zhu, K.X., Zhou, Z.Z., 2012. "Research Note-Lock-in Strategy in Software Competition: Open-Source Software vs. Proprietary Software,". Inf. Syst. Res. 23:2, 536–545.