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Organizing Continuous Product Development and Commercialization: The Collaborative Community of Firms Model

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The increased importance of knowledge creation and use to firms' global competitiveness has spawned considerable experimentation with organizational designs for product development and commercialization over the last three decades. This paper discusses innovation-related organizational design developments during this period, showing how firms have moved from stand-alone organizations to multifirm network organizations to community-based organizational designs. The collaborative community of firms model, the most recent organizational design in this evolutionary process, is described in detail. Blade.org, a purposefully designed collaborative community of firms dedicated to the continuous development and commercialization of blade servers, a computer technology with large but unforeseeable market potential, is used as an illustrative case. Blade.org's organizational design combines a community "commons" for the collective development and sharing of knowledge among member firms with explicit institutional mechanisms for the support of direct intermember collaboration. These design elements are used to overcome the challenges associated with (1) concurrent technological and market experimentation and (2) the dynamic coordination of a complex emergent system of hardware, software, and services provided by otherwise independent firms. To date, Blade.org has developed more than 60 new products, providing strong evidence of the innovation prowess of the collaborative community of firms organizational model. Based on an analysis of the evolution of organizational designs and the case of Blade.org, implications for innovation management theory and practice are derived.

Introduction

Firms face many difficulties in commercializing new technologies (Christensen, 1997; Markman, Siegel, and Wright, 2008; Moore, 1991), and recently scholars have proposed organization design as the solution (e.g., Christensen and Raynor, 2003; O'Connor and DeMartino, 2006). Historically, firms attempted to commercialize their newly invented technologies by "going it alone"—relying mostly if not entirely on their own ideas and resources to achieve success in the marketplace. However, with the advent of newer organizational forms such as multifirm network organizations (Miles and Snow, 1986; Thorelli, 1986) and community-based organizational designs (Lee and Cole, 2003; Miles, Miles, and Snow, 2005; von Hippel, 2005), firms with complementary technological (Powell, Koput, and Smith-Doerr, 1996) and marketing capabilities (Henderson, 2006; Slater and Mohr, 2006; Slater and Narver, 1995) frequently work together to develop new products and services.

This conceptual paper discusses the collaborative community of firms model as the most recent organizational approach designed to achieve continuous product development and commercialization. The model overcomes many of the innovation challenges identified in the technology and innovation management literatures, particularly those related to continuous technological and market experimentation characteristic of *analyzer* firms (Miles and Snow, 1978) and those related to the coordination of *complementor* firms (Brandenburger and Nalebuff, 1997). Blade.org, a collaborative community of more than 250 firms that has developed more than 60 new products based on the "BladeCenter" computer server technology invented by IBM, is used as the main example to illustrate this new organizational design. By becoming a member of Blade.org, an innovation-oriented firm can find willing partners to form temporary collaborative innovation networks that develop customized solutions for customers. Thus, a firm can maintain its existing independent businesses while simultaneously collaborating with other firms to explore and develop new products and customer sets.

The paper is organized as follows. First, the Miles–Snow typology of prospectors, defenders, and analyzers

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is used to describe how in the past firms conducted the innovation process by operating independently. This is followed by an explanation of how and why multifirm network organizations can be more innovative than firms acting alone, along with a description of how prospectors, analyzers, and defenders locate their strategic role in multifirm networks. Third, a discussion of how certain features of communities can be used to leverage the innovation capabilities of networks is presented, first by reviewing the literature on communities and then by analyzing Blade.org. The analysis of Blade.org focuses on the structures and processes that it employs to develop and commercialize products in complex markets characterized by multiple interdependent suppliers and complementors as well as uncertainty about future product needs and the ways to meet them. Fourth, implications of the new collaborative community of firms model for innovation management theory and practice are discussed. Finally, the conclusion argues that this evolving organizational model is likely to spread as its ability to innovate becomes even more powerful.

BIOGRAPHICAL SKETCHES

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Aligning Capabilities with Opportunities in a Dynamic Environment

The past three decades have witnessed considerable evolution in organizational designs. Miles and Snow (1978) presented a theoretical framework that describes how organizations adapt to their environments. Their framework has two main components: the adaptive cycle and four types of organizations. With respect to the adaptive cycle, firms constantly face adaptive challenges that can be classified into three broad categories: the entrepreneurial problem, the engineering problem, and the administrative problem. The entrepreneurial problem refers to the various domains the firm chooses to operate in—its products and services, types of customers, and the geographic spread of its target markets. The engineering problem encompasses the technologies by which the firm produces its products and services as well as the distribution systems used to deliver products and services to customers. Last, the administrative problem refers to the organizational structures and management processes the firm uses to operate on a continuing basis. The administrative problem has both "lagging" and "leading" aspects. The lagging aspect involves rationalizing and improving the various activities and systems that have been established, helping the firm to become ever more efficient at what it is trying to do. The leading aspect refers to innovation: building and refining the administrative processes that allow the firm to develop the innovations needed to remain effective in a changing environment. The lagging–leading notion can also be used to describe how a firm learns to simultaneously exploit its existing businesses while exploring new things to do (March, 1991). Subsequent research on strategic innovation management has examined procedural, structural, and relational solutions to the engineering and entrepreneurial problems (Dyer and Hatch, 2006; Hansen, 1999; Henderson and Cockburn, 1996; Wheelwright and Clark, 1992) as well as the capabilities associated with the administrative problem (Eisenhardt and Martin, 2000; Teece, Pisano, and Shuen, 1997).

The original studies conducted by Miles, Snow, and their colleagues in the 1970s, which took place in the college textbook publishing, health-care, electronics, and food processing industries, showed that there are three common routes that firms can take as they move through the adaptive cycle: prospector, defender, and analyzer. Each of these labels indicates the strategy the firm uses to compete in its chosen

markets, and each type has its own management system that is specifically suited to its strategy. Miles and Snow (1984) argued that a firm's overall strategy must fit its environment (external fit), that organizational structures and management processes must be aligned with strategy (internal fit), and that the entire organization must continually adapt to maintain fit over time (dynamic fit). Subsequent research has examined in greater detail the link between these strategy types and performance (e.g., Hambrick, 1983; Zajac and Shortell, 1989) as well as the moderating effects of organizational attributes, processes, and capabilities (e.g., Olson, Slater, and Hult, 2005; Slater, Olson, and Hult, 2006). The three types are briefly described as follows:

> Prospectors *are firms that continually develop new products, services, technologies, and markets. They achieve success by moving first relative to their competitors, either by anticipating the market based on their research and development efforts or by building a market through their customer-relating capabilities.*

> Defenders *are firms with stable product or service lines that leverage their competence in developing process efficiencies. They search for economies of scale in markets that are predictable and expandable.*

> Analyzers *are firms that use their applied engineering and manufacturing skills to make a new product better and cheaper, and they use their marketing resources to improve product sales. They search for proven technologies with significant potential for generating new products and services.*

Viewed from the perspective of the industry as a whole, innovation often occurs because all three strategy types are present (Miles, Snow, and Sharfman, 1993). That is, analyzers follow prospectors into new markets but tend to focus on those markets in which they already have products that can be enhanced or in which they have a particular process advantage. The unique capability of analyzers lies in their ability to envision the market potential for a new product or technology and their skill in rapidly commercializing innovations—in essence, the ability to extend a technology to a larger domain than that envisioned by its originators (Haanæs and Fjeldstad, 2000). Thus, whereas prospectors seek returns based on their ability to invent, analyzers seek returns based on their ability to perform product modifications and enhancements using established technologies. For their part, defenders focus on standardizing the technologies and products developed by other firms while lowering overall costs by becoming increasingly efficient.

Empirical research on the Miles–Snow typology (see Zahra and Pearce, 1990, for a review) showed that prospectors, defenders, and analyzers can coexist in an industry (although there are performance differentials depending on industry type). The competitive landscape of most industries at the time of the original Miles–Snow research (1960s and 1970s) is seen to be a mix of prospector, defender, and analyzer firms, each of which is competitive if its capabilities, structures, and management processes are closely aligned with its strategy. Each type of firm controlled most if not all of the resources it needed to perform its chosen set of activities. In a recent analysis of a large sample of U.S. and Chinese firms, DeSarbo et al. (2005) provide empirical support for the original typology, but their findings indicate that firms strengthen their capabilities in areas beyond those expected of pure prospectors, defenders, and analyzers. In effect, each type tries to reduce some of the trade-offs associated with its particular strategic approach and to achieve what has been referred to as organizational ambidexterity (Raisch et al., 2009; Tushman and O'Reilly, 1996; Zi-Lin and Poh-Kam, 2004).

The Rise of Multifirm Network Organizations

During the post-World War II years, prospector, defender, and analyzer firms tended to operate as independent, self-contained firms. Beginning in the 1970s, however, the U.S. competitive landscape began to change dramatically. As chronicled in best-selling books such as *In Search of Excellence* by Peters and Waterman (1982), most large hierarchically structured firms of the time struggled to adapt to the global economy's changing markets and technologies. Only after much organizational disruption and upheaval—which produced a variety of new adaptive mechanisms such as outsourcing, off-shoring, downsizing, and delayering—did a new organizational form emerge that appeared to have the potential to reverse the declining competitiveness of many U.S. firms.

That organizational form is called the multifirm network (Miles and Snow, 1986; Thorelli, 1986). Network organizations are different from traditional hierarchical organizations in several respects. First, instead of holding in-house all the resources required to produce a given product or service, networks use

the collective assets and resources of several (or many) firms located along the industry value chain (Porter, 1985). Second, networks rely heavily on market mechanisms to manage decision-making processes and resource flows (Halal, Geranmayeh, and Purdehnad, 1993). Those mechanisms, however, are not the simple arm's-length relationships usually associated with independently owned economic entities. Rather, members of the network recognize their interdependence and are willing to share information, to work with one another, and to customize their product or service—all to maintain their position within the network. Last, many networks expect their members to play a proactive role, to voluntarily engage in behavior that improves the final product or distribution system rather than simply fulfilling a contractual obligation. Early multifirm networks sought the efficiency provided by the specialized skills and assets associated with the defender; the flexibility and responsiveness expected of the prospector's innovation-oriented teams and divisions; and the analyzer's ability to shift resources laterally across internal organizational units (Miles and Snow, 1994). Accordingly, each of the strategy types began to gravitate toward its natural place within the multifirm networks that were being formed in the 1970s and 1980s. Often, a "lead" firm would launch the formation process by locating relevant suppliers and incorporating their products, services, and activities into a coherent network. The result can be a very large and complex network as, for example, that of Wal-Mart's present network of 60,000 suppliers.

Two examples, one a prospector and the other an analyzer, illustrate how lead firms use networks to reduce the trade-offs faced by pure strategy types in the product development and commercialization process.

Apple Inc. is widely recognized for its prospecting capabilities. Since its founding in 1976, the firm has developed many new products. The company's best-known hardware products include the Macintosh line of personal computers, the iPod line of portable media players, and the iPhone. Apple's software products include the Mac OSX operating system, iTunes media browser, the iLife suite of multimedia and creativity software, and Final Cut Studio, a suite of professional audio and film-industry software products. While Apple devotes its own resources primarily to technology and product innovation and design, it draws on a worldwide network of other firms to provide manufacturing, sales, and distribution services. Innovation-centered firms such as Apple have taken advantage of networks as a way to exploit the efficiency gains from network partners such as the Taiwanese original design manufacturer Hon Hai.

Several large pharmaceutical companies, including Roche Inc., are perfecting their roles as analyzers by allowing prospecting to be done by many small, highly specialized biotechnology firms. Most small biotech firms are venture funded, and their main activities are directed toward the discovery of the genetic properties of some organism or toward the efficient replication of biological or biologically derived matter such as organs or hormones. Some biotech firms operate for years without substantial revenues, relying on the funds provided by their investors, and then they enjoy a single large payoff in the form of being acquired by a large pharmaceutical firm. Other biotech firms patent or license their technology, take on contract work, or do both. Relying on either the acquisition or licensing model (or both), Roche and other large pharmaceutical companies constantly scan the industry for promising research projects. Thus, commercialization-oriented analyzer firms, such as the major pharmaceutical companies, have taken advantage of networks to increase the variety of sources of new products and technologies.

In summary, the motivation for networking among firms in knowledge-intensive industries such as telecommunications equipment and biotechnology is to accelerate and broaden their joint learning (Audretsch and Feldman, 2003; Hemphill and Vonortas, 2003; Powell et al., 1996). The multifirm network organization combines its members' complementary resources and activities, and it allows each firm to leverage its particular set of capabilities. A network organization's greater combinatory flexibility reduces innovation time, enhances commercialization opportunities by exploiting downstream partners' market access (Hagedoorn, 1993), and allows exploration-oriented firms to exploit the efficiency of their network partners.

Enhancing Multifirm Networks With Features of Communities

The multifirm network model offered significant organizational improvements in both effective market exploration and efficient operations over the traditional model of the self-contained, vertically integrated firm. The main strength of the network form of organizing is the ability to combine firms for the purpose of creating and delivering specific products

and services. For the most part, early networks emulated the basic organizational design of mature hierarchical firms, substituting a system reflecting market-based decisions and local management for one of centralized planning and control. Thus, the multifirm network was a new organizational design that evolved from a continuing stream of improvements to existing hierarchical designs.

Beginning in the late 1980s and early 1990s, especially in so-called high-velocity environments (Eisenhardt, 1989; Eisenhardt and Brown, 1998), firms began to face a new set of challenges and moved from what Miles and Snow (1994) referred to as "stable" networks toward a "dynamic" network form. High-velocity environments characterize newer technologies and businesses, especially those that cluster around a geographic area where the core technology research is located. Early dynamic networks, for example, appeared in the cluster of electronics and computer firms located in Silicon Valley (California), the Route 128 corridor (Boston), and in Austin, Texas (Saxenian, 1994). In high-velocity environments, rapid technological and market changes challenge the stability of particular network configurations because changes in product or service components often require forming new cross-firm relationships while dropping others. As a result, network member firms often find themselves moving in and out of particular networks and markets. Typically, new markets will be related in many technological aspects to existing markets, and therefore adaptations can be made to enhance the performance of products and services originally designed for one market to take on even greater value in another market. In some instances, it may be that only one component or subsystem of a firm's existing products will be used in the offering created for the new, related market. In other instances, products from two or more firms might be combined with those of another "exploring" firm to offer a completely new product design to a new market.

Beginning in the late 1990s and continuing to the present, firms began to move toward a new business model housed in a new organizational form, a form that incorporated both independent firms and their networks as building blocks. Initially, this new organizational form was referred to as the "federation" model (Handy, 1990; Miles, Snow, and Miles, 2000) and later as the "community" model (Miles et al., 2005; von Hippel, 2005; von Krogh, Spaeth, and Lakhani, 2003; Wenger, 1998). Within some industries, notably biotechnology, computers, telecommunications equipment, medical equipment, and nanotechnology, pioneering firms are currently exploring the community model for the purpose of assuring the full utilization of continuously developing knowledge (Miles et al., 2009). However, while the organizational designs of early supply chain networks were clearly modeled on those of vertically integrated firms, neither the purpose nor the core organizational and governance requirements of the community model have obvious precedents. Both their purpose and their main organizational features are emerging as they evolve.

A number of firms are presently establishing or joining communities of other firms with the overall purpose of enabling knowledge sharing and providing mechanisms and infrastructure services that improve the participants' ability to network both within the community and outside the community. Communities nurture the capabilities of their members, and they provide shared services that allow the firms to collaborate with one another and to accomplish more than they could achieve on their own. From an organizational perspective, the emergence of communities requires looking beyond the established multifirm networks within which particular products and services are produced to an organizational design in which firms share knowledge and use commonly held resources to pursue innovation projects that have commercial potential across related markets. A community of firms is a form of organization in which independent member firms network with one another but also commit to a set of shared values and norms and where there are mechanisms to exert moral suasion and to extract compliance from members. The broad emergence of community-like structures across strategy types, industries, and geographies leads to the proposition that the community model of organizing is a strong complement to the network model of organizing. To understand how firms that form or participate in communities achieve long-term competitive success, one needs to know (1) the various forms communities may assume and (2) the different ways firms can use communities to leverage their innovation efforts.

Community Forms

Although there are hundreds of thousands of existing innovation-related communities that come in a variety

of forms, the vast majority of them can be classified using two main dimensions: (1) the predominant means of participation (closed vs. open); and (2) the predominant governance structure (hierarchical vs. flat) (Pisano and Verganti, 2008). Research on open participation combined with hierarchical governance has examined crowd-sourcing as a problem-solving model (Brabham, 2008), the potential and limitations of innovation contests and multiagent problem solving (Terwiesch and Xu, 2008), and the effectiveness and efficiency of broadcast search approaches (Lakhani et al., 2007). Research on open participation and flat governance communities has focused primarily on open-source software (OSS) communities. In particular, researchers have studied the motivations of OSS contributors (e.g., Harhoff, Henkel, and von Hippel, 2003; Lakhani and von Hippel, 2003; Lerner and Tirole, 2002), the governance of OSS communities (e.g., Kogut and Metiu, 2001; Lee and Cole, 2003; O'Mahony and Ferraro, 2007; West and O'Mahony, 2005), and the business models, strategies, and competitive dynamics induced by OSS communities (e.g., Bonaccorsi and Rossi, 2003; Dahlander and Magnusson, 2005; Dittrich and Duysters, 2007; Henkel, 2006; West, 2003). Also, there is a growing body of literature on how firms can benefit from open user communities, both online and offline, which develop physical products (Baldwin, Hienerth, and von Hippel, 2006; Franke and Shah, 2003; Fueller, Jawecki, and Muehlbacher, 2006; Hienerth and Lettl, 2011). Research on closed participation and hierarchical governance has investigated collaborative relationships such as lead-user involvement in innovation projects (Herstatt and von Hippel, 1992; Lilien et al., 2002), university–industry collaborations (Fontana, Geuna, and Matt, 2006; Tether and Tajar, 2008), and elite designer circles centered on a particular firm (Verganti, 2009).

In the final category of closed participation and flat governance, there is a large and diverse body of research that has examined a variety of organizational forms in which firms cooperate with one another as peers. Researchers have investigated industrial consortia where a private group of participating firms jointly select problems, decide how to conduct work, and choose solutions (Pisano and Verganti, 2008). Other researchers have examined federations of firms, including the conditions conducive to their formation, and how federations build both internal and external legitimacy (Human and Provan, 2000; Provan, 1983). Also included in this category is research on industrial districts, such as those composed of textile manufacturing firms in certain regions of Italy (Piore and Sabel, 1984) and the group of firms in the New York City fashion community (Uzzi, 1997), which examines how embedded ties among firms affect their economic behavior (e.g., risk taking and the sharing and coordination of work). Last, studies on industrial clusters, which are geographic concentrations of associated firms such as the worldwide wine cluster with multiple centers in western and southern Europe, the western United States, and southern Australia (Porter, 1990, 1998), have examined knowledge spillovers and competitive dynamics within clusters.

As the reviewed studies show, communities are an ever-expanding source of diverse technical knowledge, shared standards, and contexts that firms use to innovate. The common thread running through these studies is captured by the concept *community of practice*. Community of practice refers to the social learning that occurs when individuals who have a common interest in some topic or field collaborate over an extended period of time to share knowledge and experience, develop solutions, and build prototypes (Lave and Wenger, 1991). Communities of practice can cut across firm boundaries, and as a result knowledge may flow more effectively between firms (Brown and Duguid, 1991, 1992). Thus, innovation is becoming increasingly open and organized within communities of firms and individuals who collaboratively explore and exploit knowledge (Chesbrough, 2003, 2006; Chesbrough, Vanhaverbeke, and West, 2006; von Hippel, 2005).

Using Communities to Leverage Innovation and Commercialization: The Case of Blade.org

The most recent type of community is focused on the innovation and commercialization of technology. In this type of community, such as Blade.org, a particular innovative technology has a large, but not fully understood, market potential. Here the purpose is to provide an arena in which firms that are members of the community can work with one another to develop products and services based on the technology. The innovation and commercialization capacity of such a community is much larger than the aggregate capacity of individual firms working alone.

Blade.org (http://www.blade.org) is a purposefully designed community of more than 250 firms dedicated

to the development, manufacturing, marketing, and distribution of products based on the blade technology invented by IBM in the 1990s. The Blade.org community as a whole has taken on the product commercialization functions typical of analyzers. The community consists of a variety of firms that complement each other with respect to the different capabilities required to develop the blade server market. Blade.org is a largely self-governing community, but it has a principal office that provides infrastructure services and strategic initiatives that benefit the community as a whole.

Web servers, e-mail servers, database servers, and file servers are examples of server applications. Blade servers are ideal for Web hosting and cluster computing. ''Blades'' are small dart-shaped devices that, when plugged into a rectangular enclosure, perform as full-fledged computer servers. A blade server ''solution'' consists of two hardware components—the blades themselves and the enclosure that holds them—as well as software to manage real and virtual server resources. The enclosure housing the blades is configured to fit a customer's data storage and computing needs. A particular enclosure might hold more than a dozen blades (servers), but the overall capacity depends on the functionality built into the enclosure. The main benefits to a company that buys a customized solution are lower fixed costs due to the smaller physical space required to house the equipment, lower energy costs to operate the equipment, and ease of maintenance and data management tasks. As more processing power, memory, and input/output (I/O) bandwidth are added to blade servers, they can be used for more demanding and diverse tasks.

Origin and Purpose

The origin of Blade.org can be traced to August 2004 when IBM announced that it was opening the specifications to its BladeCenter server chassis (Clabby Analytics, 2007). IBM stated that its goal was to build a developer community that would focus on expanding the number of solutions that could be made available from its promising blade architecture. IBM also noted that it could not drive all innovation on blade applications itself; it anticipated that its partners would play a major role in developing future blade-based solutions. In February 2006, IBM announced the formation of an independent organization (Blade.org) that would house a community of complementor firms, and it invited vendor and user firms to provide feedback and to develop products specifically for BladeCenter.

The economic purpose of Blade.org is to foster and accelerate the growth of solutions based on the blade platform. The specific purposes for which Blade.org is organized include enabling the ongoing development of blade platform-based solutions, helping to bring solutions to the market in a timely fashion, increasing the adoption and number of solutions in both existing and new markets, and increasing end-user confidence in blade platform solutions. The Blade.org community undertakes a wide variety of activities to achieve these purposes, including the provision of guidelines to member firms for designing their solutions, developing independent compliance testing procedures that member firms may use, hosting industry-wide SolutionFests and other marketing events, educating the marketplace on blade platform solutions, and incorporating member concerns and preferences into strategic initiatives that expand and improve the community.

Membership and Governance Structure

Unlike many open innovation communities where the governance structure emerged over time (O'Mahony and Ferraro, 2007), the main elements of the Blade.org governance structure have been purposefully designed by the founding member firms. Blade.org has three membership categories: governing members, sponsoring members, and general members. Governing member firms, each of which has a representative who sits on Blade.org's board of directors, are limited by the organization's bylaws to 11 in number and include the original eight founding firms (Brocade, Citrix, IBM, Intel, Network Appliance, Nortel, Novell, and VMWare). Governing member firms pay annual membership dues (as do all member firms except customers), entitling them to certain rights (www.blade.org Membership Benefits, 2008; Bylaws of Blade.org, 2006). The complete list of these rights is shown in Table 1. Of the various rights, the core rights that accrue from membership in Blade.org are opportunities to collaborate with other member firms and eligibility for participation in the work of committees and subcommittees.

Sponsoring member firms are of three types: (1) They are currently distributing or developing hardware, software, or services offerings for the blade platform; (2) they provide consulting or distribution

Table 1. Blade.org Member Rights

Opportunities to collaborate with other Blade.org solution providers
Influence the direction of the Blade.org server market
Networking opportunities with industry leaders at trade shows and other industry events
Increased visibility within the marketplace
Ability to leverage Blade.org's marketing activities including use of the Blade.org logo in promotional literature
Use of independent compliance testing arranged by Blade.org
Increased media coverage through access to Blade.org's public relations firm
Speaking opportunities at Blade.org events
Free banner advertising on the Blade.org website and various discounts
Ability to appoint a member of the board of directors
Eligibility for their employees to serve as chair of a committee or subcommittee and to participate in the activities of any committee or subcommittee
Influence the agenda of all-member meetings

support for blade-based solutions or products; or (3) they currently use blade platform solutions. Sponsoring members have the same rights as governing members except for the right to appoint a representative to the board of directors. Last, a firm can become a general member of Blade.org if it has a legitimate business interest in participating in the community and is willing to publicly support Blade.org and its mission by being listed on the organization's website and in press releases. A general member must be approved for membership by a majority vote of Blade.org's board of directors.

In early 2008, Blade.org began to offer free membership to its customers (called "end users"). End-user membership benefits include invitations to participate in a variety of technical and marketing activities, an opportunity to join any Blade.org committee or subcommittee, access to a forum where end users can voice concerns and suggestions directly to Blade.org vendors, and an opportunity to network with other firms, which allows customers to share best practices within the blade community. Overall, such benefits allow customers to influence the direction of the blade market as well as technology development.

Blade.org operates as a "program" under the auspices of the Industry Standards and Technology Organization (ISTO). ISTO, whose parent organization is the well-established Institute of Electrical and Electronics Engineers (IEEE), was started in 1999 as a not-for-profit corporation that offers industry groups (e.g., consortia, special interest groups, alliances, forums, working groups) support for technology and standards development. The IEEE-ISTO serves as an umbrella organization to provide a legal forum for industry groups to operate without the need to incorporate. Programs of the IEEE-ISTO enjoy the legal protections and insurance benefits of operating within an incorporated, fully insured, nonprofit organization. The IEEE-ISTO provides a complete menu of management and operational support, leaving Blade.org's member firms free to focus on the community's mission and activities.

Blade.org has a principal office located in Research Triangle Park, North Carolina (contiguous to the cities of Raleigh, Durham, and Chapel Hill). The principal office houses the strategic leadership of Blade.org, and its executives plan and organize strategic initiatives designed to expand and enrich the community. In addition, Blade.org has nine committees composed of volunteers from the member firms. These committees are organized by function and include committees on technology, solutions architecture, hosted client work group, power and cooling, compliance and interoperability, marketing, small and medium businesses, membership benefits, and bylaws and membership. The Blade.org volunteer committees perform a dual function for the community: they do work that is useful to the community as a whole, and they serve as a repository of knowledge that member firms can tap into when needed. Thus, the committees are keepers and developers of the community's knowledge commons.

Collaborative Innovation Processes

In less than two years, Blade.org member firms developed 60 solutions, an indication of the overall success of the community in creating innovative products and services. Solutions are explored through a variety of knowledge-sharing processes, including website postings, the work of the technical committees, and participation in all-member meetings and other community events. Interfirm collaboration occurs both within and outside Blade.org in the sense that member firms collaborate with their customers (end users) in the development of customized solutions, and they collaborate with one another to produce solutions for existing or new customers. On any given innovation project, collaboration can take one of four basic forms: (1) *bilateral collaboration* (this type of innovation occurs when a Blade.org member firm collaborates with its customers on new solutions, perhaps using consulting advice from IBM as the inventor of the blade technology); (2) *direct collaboration* (a few

member firms work together on the development of new solutions); (3) *pooled collaboration* (Blade.org member firms supply ideas, information, and experiences to a central database called Bladeuser.org that is accessible by other member firms to pursue innovation projects); and (4) *external collaboration* (a Blade.org member firm works with a non-Blade.org firm on a one-off innovation project).

Analysis of Blade.org's Strategic Role

Blade.org is an early example of a *collaborative community of firms*. Its founders, especially IBM, have prior experience with open-source communities. Although Blade.org in significant ways, elaborated subsequently, differs from open-source communities, its architecture also represents a continuation of their purpose and form. Blade.org represents a significant step forward in the evolution of the community form of organization, and there is reason to believe that future forms will build on the learning to be gained from experimentation with this form and will continue to advance the architecture depicted in Figure 1.

The key to understanding Blade.org as an organizational design is to consider the strategic role it is playing. IBM was the inventor of the blade technology, and it holds a number of patents related to that technology. Given IBM's size and capabilities, creating one or more dedicated blade business units that, in turn, would partner with select suppliers and lead users would be the taken-for-granted approach to finding market applications for the blade technology. However, rather than exploiting the blade intellectual property through its own business units or through specific technology alliances with other firms, IBM, along with its fellow founding companies, chose to form a collaborative community of firms focused on accelerating the development and adoption of blade server solutions. In this sense, the entire Blade.org collective is playing the role of an analyzer.

The nature of research and development (R&D) is the generation, selection, and development of ideas (Henderson and Stern, 2004). Combining diverse ideas from a large network with close collaboration among specific network members improves idea development (Uzzi and Spiro, 2005). The organizational

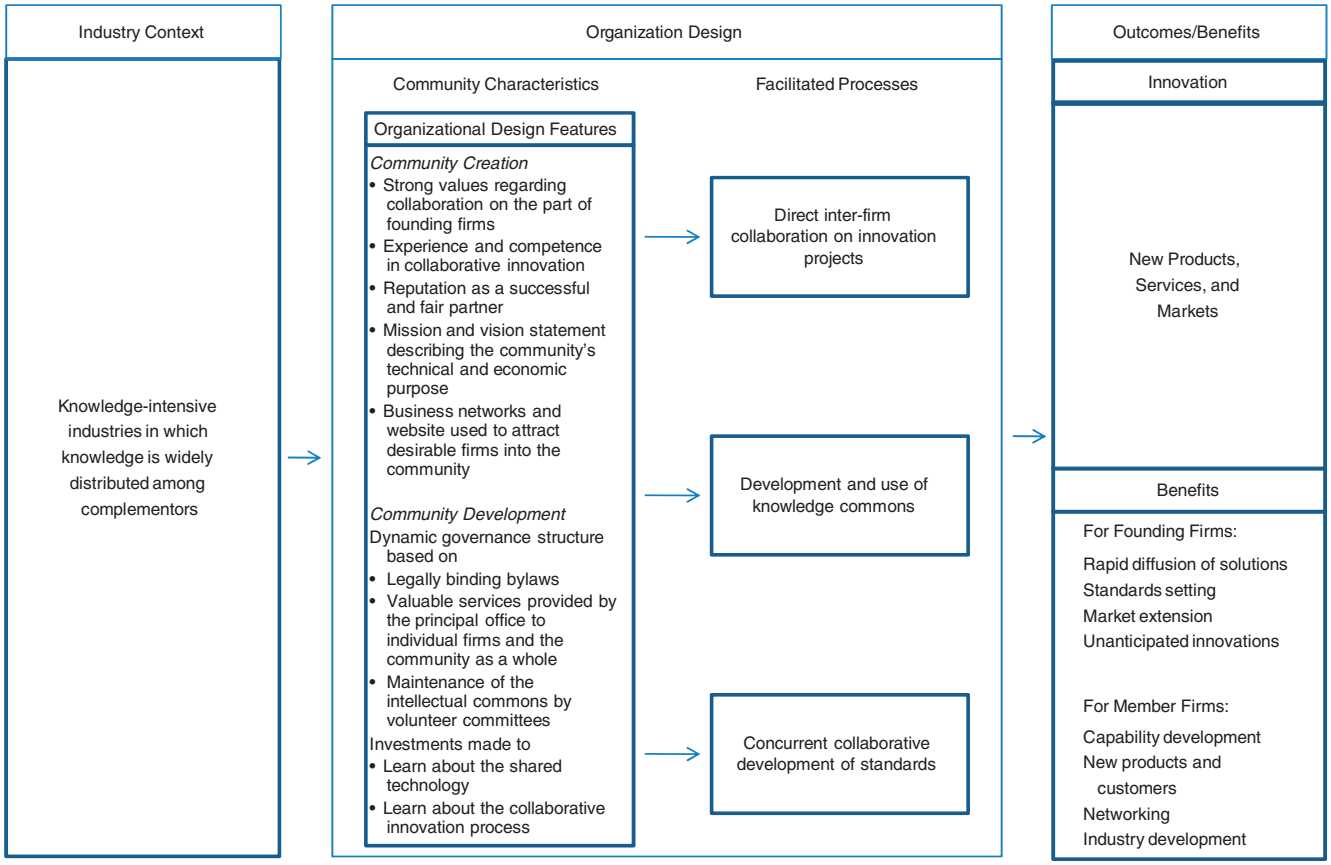

Figure 1. Collaborative Community of Firms: Industry Context, Organization Design, and Outcomes and Benefits

challenges faced in commercializing a new technology are related to dynamically piecing together all of the components and actors required to develop, market, and install the derived products or services (Wheelwright and Clark, 1992). Echoing this, the motives usually cited for the formation of strategic alliances are obtaining access to new markets and technologies, speeding products to market, and pooling complementary skills and resources (Hagedoorn, 1993). The single-firm analyzer coordinates the complex processes of simultaneously establishing, developing, and adapting its existing system to new products through a matrix organization structure (Miles and Snow, 1978). Multifirm networks, in which the parties respectively provide new technologies and market access—including the organizational activities and resources required to effectively operate in those markets—extend the commercialization function of the analyzer to interfirm relationships. In the network form of organizing, the analyzer is likely to operate as a ''broker'' that reconfigures its network of firms as required to commercialize new products and exploit the market until more efficient defenders take over (Miles and Snow, 1994).

The single-firm or network-based analyzer will be organizationally constrained when the set of actors required is large and diverse. Both market-related factors, such as extensive adaptations being required to match market needs, and product-related factors, such as the need to combine multiple technologies, may increase network size and complexity. When time to market and rapid organizational adaptation are factored in, the single-firm or network analyzer may be insufficient for continued effectiveness at the commercialization of innovative technologies, processes, and products. In response to this constraint on the simultaneous exploration and exploitation of knowledge, it appears that community forms of organizing are more conducive to the effective performance of analyzer functions. The member firms of Blade.org also constitute a network of complementors who depend on one another for successful product development and commercialization. Despite significant coordination challenges in markets where complementors exist (Farrell and Klemperer, 2007), such networks have previously tended to evolve spontaneously rather than through deliberate design. Blade.org exemplifies a shift toward the explicit formation and facilitation of complementor networks in which a knowledge commons is used to enable the simultaneous development of both products and standards.

As a successful collaborative community of firms, Blade.org represents the most recent organizational solution to the challenges faced by firms as they attempt to continuously develop and commercialize new products and services. Blade.org's principal office acts as a facilitator (Stabell and Fjeldstad, 1998), linking firms that are or wish to be interdependent (Thompson, 1967). The community supports its member firms in the pursuit of common objectives, enhancing their capabilities through collective learning and providing the infrastructure needed for building network relationships among members.

The collaborative community approach to product development and commercialization offers at least two major benefits over existing multifirm network forms. First, the community provides a setting for the development of both common knowledge and interfirm trust. The goal is the rapid development of solutions, and the community structure is an efficient way of keeping all the participants in touch with the growing knowledge base regarding the technology and its potential market applications. Furthermore, the bounded and formal membership fosters trust among the member firms, which is likely to increase both open knowledge sharing among firms and knowledge sharing in dyadic relationships between firms. Second, the size of the community, coupled with support for dyadic or multilateral relations among firms, enables the mobilization of the wide variety of resources required and is likely to increase the creativity and productivity of each of the member firms in their own efforts (Uzzi and Spiro, 2005).

Discussion and Implications

The pace of evolution of new community-based organizational forms for innovation and commercialization will depend on how quickly and clearly their purpose and processes are defined and understood. The overall purpose of such communities is to provide an ongoing, trust-based environment in which firms can share technical and market knowledge with both current and potential partners without fear of exploitation and with the expectation of common gain. Contrasting early open-source communities with Blade.org reveals an important difference in these two community-based organizational forms. Open-source communities are primarily organized around contributions to a commons that is collectively and privately exploited (von Hippel and von Krogh,

2003). Sharing knowledge through a commons is highly efficient and effective; it virtually eliminates networking costs among participants. The newer community design exemplified by Blade.org, however, supports direct commercial relationships among its members in addition to expanding the knowledge commons. Thus, a collaborative community of firms facilitates both pooled and direct linkages among members (Stabell and Fjeldstad, 1998) and contributes to the theoretical understanding of community-based organizational designs both in form and purpose.

Firms perform well when their capabilities, structures, and processes are aligned with their choice of markets and their strategic posture. Path dependencies dynamically reinforce the necessity of specialized types of firms that can align internal capabilities with external opportunities (Arthur, 1989; Arthur, Ermoliev, and Kaniovski, 1987). In theoretical terms, organizational evolution is characterized by newer designs relieving constraints on efficiency and effectiveness associated with their predecessors. Specifically, the multifirm network organization allows individual firms to accentuate their capabilities without subjecting themselves to the penalties to efficiency or effectiveness faced by the vertically integrated firm. However, there are also transaction costs associated with developing and maintaining productive interfirm relationships, and those costs will limit the number of relationships that a firm can maintain (Burt, 1992; Williamson, 1985). Continuous product development and commercialization require (1) access to new ideas from a wide variety of sources and (2) deep knowledge sharing among partner firms (Granovetter, 1973, 1985; Hansen, 1999, 2002; Uzzi and Spiro, 2005). Reputation is important in the formation of relationships because it is a signal of trustworthiness. In a large community, it is difficult for member firms to know and stay informed about each other's behavior; thus, free-riding may occur (Alchian and Demsetz, 1972; Makadok and Coff, 2009). However, leadership, widely shared norms, and knowledge conducive to community collaboration can enable self-organization (Ostrom, 1990, 2009). In addition, Milgrom, North, and Weingast (1990) showed that central institutional actors can promote honesty and can increase exchange among partners who interact infrequently and hence reduce agency costs (Jensen and Meckling, 1976). Hence, the shared values, norms, infrastructure, and leadership processes designed into Blade.org offer an effective institutional context for collaboration among its member firms.

As the newest means of organizing, the collaborative community of firms model represents an emerging organizational design that enhances the multifirm network design. The community model offers member firms the opportunity to collectively develop capabilities and to increase the efficiency and effectiveness of their networking and collaboration. The collaborative community of firms model will increasingly be used in situations where (1) the market potential of a new technology is not foreseeable or (2) it is crucial to "win the race" in terms of becoming the industry standard.

The analysis of the evolution of organizational designs and of Blade.org has several implications for innovation management theory and practice. First, research is needed to determine how different community-based organizational designs affect product innovation and commercialization in different kinds of industries and with different shared interests. Open-source communities have proven to be very innovative, but the collaborative community Blade.org has as its purpose the commercialization of a particular technology. Such a focus implies that community membership should be designed around complementarity, and admission should be by invitation only. Second, there is a need for a better understanding of how to manage collaborative communities of firms, especially in terms of developing the required organizational processes and capabilities. The experience of Blade.org indicates that the community must have formal mechanisms for facilitating the direct networking of member firms and for sharing knowledge through a commons. Such mechanisms must allow firms maximum freedom to pursue and manage their joint innovation projects. Third, there is a need for research on the competitive effects of communities and their implications for policy and regulation. As more communities of the size and complexity of Blade.org appear, they will challenge existing conceptions of competition and collaboration. Last, managers can use the collaborative community of firms model as the basis for thinking about founding, joining, and managing communities that are effective for product development and commercialization as well as how to combine the features of communities with other organizational designs. The Blade.org findings indicate that firms can maintain the benefits associated with their independent status while enhancing their innovation capabilities through interfirm collaboration.

Conclusion

The original studies by Miles and Snow (1978) were prompted by the realization that organizational evolution was occurring in response to the emergence of new technologies and market opportunities spawned by various scientific breakthroughs following World War II. Today, the potential of the global scientific community is far greater and the pace of technological and market change is much faster than in prior decades. So, too, are the opportunities for innovations in organizational forms. However, as was the case in the 1960s and 1970s, successful organizational innovation will depend on the ability of existing organizations to develop the strategies and structures needed to keep pace with environmental change. In the 1960s and 1970s, the most effective firms honed their market strategies and supported them with appropriate organizational structures and management processes. In the 1980s and 1990s, the most effective firms disaggregated their activities and processes, and they forged relationships with other firms to improve both production efficiency and market responsiveness through stable and dynamic multifirm networks.

Currently, pioneering firms are experimenting with new ways of using the knowledge flowing into their industries and responding to the market opportunities it is generating, even as they bring new products and services to market at an ever-increasing rate. Within such an environment, it seems inevitable that the most successful firms will be those that learn how to embed themselves and their networks in a valuable new organizational form—a designed community of firms sharing knowledge and engaging in collaborative relationships with community partners to develop and commercialize new products and services.

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