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Toward a Framework of Web 2.0-Driven Organizational Learning

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Abstract:

During the past few years, Web 2.0 applications have changed the Web from a search tool to a platform for collaboration. Research has also started to show that Web 2.0 applications promote organizational knowledge sharing and creation. There is not, however, a comprehensive conceptual framework that explains how the organizational use of Web 2.0 leads to organizational learning. In this article, we develop such a framework by drawing on social capital theory, the SECI knowledge creation model, and the concept of *Ba* to show how the dimensions of social capital that emerge from the use of Web 2.0 applications evolve and drive organizational learning.

Keywords: Web 2.0, social capital theory, SECI knowledge creation model, organizational learning

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I. INTRODUCTION

During the past decade, users have been experiencing major changes in their online experiences with the introduction of various Web 2.0 applications, such as blogs, wikis, social bookmarking sites, and social networking sites. For contemporary users of the Web, surfing the Internet no longer means passively receiving information. Today's Internet use involves collective acts of authorship and creativity, where users meet others to collaborate and to create and share knowledge. This change can be seen in the *Time* magazine's announcement of "You" as the Person of the Year of 2006 [Grossman, 2006] and Tim O'Reilly's [2005] idea of "harnessing collective intelligence" as the central principle behind Web 2.0 applications. These Web 2.0 applications, as a result, are creating a paradigm shift in the social creation and dissemination of knowledge. The Web today is indeed no longer a cathedral but a bazaar [Raymond, 1999].

At the age of knowledge economy, knowledge is regarded as an important strategic asset and organizations are eager to learn in order to sustain their competitive advantage [Davenport and Prusak, 1998; Grant, 1996]. Noticing the potential of Web 2.0 applications to foster collaboration and knowledge creation, organizations have started to introduce these applications into their business intranets [Bughin and Manyika, 2007; Bughin, Manyika, and Miller, 2008]. Consequently, a Wikipedia entry claims that "there may be greater use of wikis behind firewalls than on the public Internet" [Wikipedia, 2008]. The term *Enterprise 2.0* was coined to underline the strategic issues related to the organizational adoption of Web 2.0 applications [McAfee, 2006]. Academic research has also begun to focus on this phenomenon and to investigate organizational adoption, as well as employees' usage of Web 2.0 (e.g., Jackson, Yates, and Orlikowski, 2007; Skeels and Grudin, 2009). Preliminary findings highlight the capabilities of Web 2.0 applications to facilitate the formation of informal social networks and knowledge-sharing within an organization.

Despite these initial findings, there is still a lack of understanding of the processes that link Web 2.0 use to organizational learning. A theoretical conceptualization of this linkage is necessary to facilitate the synthesis of current findings and to guide empirical studies on the organizational use of Web 2.0 applications. For practitioners, such a conceptualization will provide insights into the potential of Web 2.0 applications to drive organizational learning and the mechanisms that lie behind. These insights will help managers make informed decisions on the introduction and deployment of Web 2.0 applications without treating Web 2.0 as a panacea that will create value automatically.

The purpose of this article is to bridge this conceptual gap by proposing a conceptual framework to investigate the question: "How does the organizational use of Web 2.0 applications lead to organizational learning?" We argue that social capital theory [Bourdieu, 1986; Burt, 1992; Coleman, 1988; Nahapiet and Ghoshal, 1998; Putnam, 1995], the SECI knowledge creation model [Nonaka, 1994; Nonaka, Toyama, and Byosiere, 2001], and the concept of *Ba* (roughly meaning "place" where new knowledge is created) [Nonaka and Konno, 1998] present theoretical insights to build such a framework. Social capital theory provides a theoretical lens to examine the formation, maintenance, and the consequences of emergent informal relationships out of Web 2.0 use. In addition, social capital theory has been adopted by various studies to examine organizational knowledge-creation activities (e.g., Chiu, Hsu, and Wang, 2006; Nahapiet and Ghoshal, 1998; Tsai and Ghoshal, 1998), which makes it suitable to the study of Web 2.0-driven organizational learning. The SECI knowledge creation model is concerned with organizational knowledge-creation activities that happen dynamically and incrementally through continuous social interaction. The concept of *Ba* focuses on the conditions where knowledge-creation activities occur. Social capital theory, the SECI knowledge creation model, and the concept of *Ba*, when combined cohesively in the proposed framework, will be able to facilitate the investigation of how informal social relationships formed through Web 2.0 use create the necessary conditions to support organizational knowledge-creation activities.

This rest of the article is organized as follows. Section II presents the theoretical bases on which we build our framework. In Section III, we propose our framework and show how the organizational adoption of Web 2.0 applications facilitates organizational learning. In Section IV, we elaborate on the significance of our proposed framework and discuss the implications of this framework for future research and practice. This article is concluded in Section V.

II. THEORETICAL BACKGROUND

Organizations need to learn to survive in dynamically-competitive markets [Brown and Duguid 1998; Grant, 1996]. According to the resource-based perspective, organizations need to develop and exploit strategic resources in order to sustain their profitability [Barney, 1991; Peteraf, 1993; Wernerfelt, 1984]. Knowledge, regarded as the critical resource underpinning organizational competences [Teece, 1998], has been treated as one of the most important strategic assets [Alavi and Leidner, 2001; Brown and Duguid, 1998; Grant, 1996; Nonaka and Takeuchi, 1995]. As a result, Alavi and Leidner [2001] regard organizations as knowledge systems consisting of socially enacted knowledge processes, and Nonaka, Toyama, and Nagata [2000] see organizations as knowledge creation entities. This emphasis on knowledge pushes organizations to build up their knowledge creation capabilities, as Brown and Duguid [1998, p. 91] argue, organizations' "ability to outperform the marketplace rests on the continuous generation and synthesis of collective, organizational knowledge." This view on contemporary organizations invites researchers and practitioners to explore different insights into the facilitation of organizational learning (e.g., Brown and Duguid, 1998; McDermott, 1999; Nevis, DiBella, and Gould, 1995). Following this research trend, in this article we take the view that organizational learning comes from an organization's continuous knowledge creation among individuals [Nonaka, 1994] in order to respond to the rapidly changing environment [Teece, Pisano, and Shuen, 1997]. This view concerns continual changes in the organizational collective mental model and worldview, and the corresponding changes in organizational practices [Brown and Duguid, 1991; Daft and Weick, 1984]. By taking on this "cognitive learning" perspective [Lumpkin and Lichtenstein, 2005], we also recognize organizational learning as embedded in the processes of social interaction and as context-dependent.

Many researchers have discussed the embeddedness of organizational learning in processes of social interaction. For example, Teece et al. [1994, p. 15] described organizational learning processes as "intrinsically social and collective phenomena." Nonaka [1994, p. 15] indicated that social interactions "contribute to the amplification and development of new [organizational] knowledge." Nahapiet and Ghoshal [1998, p. 253] claimed "knowledge and meaning are always embedded in a social context—both created and sustained through ongoing relationships in such collectivities." Brown and Duguid [1991, 2001] argue that individual learning is inseparable from collective learning and involves one's acquisition of the abilities to function in the community, to acquire the community's viewpoint, and to act in socially recognized ways—that is, learning through "legitimate peripheral participation" [Lave and Wenger, 1991]. Being embedded in social interaction, organizational learning is also a context-dependent process. Lave [1991] and Lave and Wenger [1991] define learning as a situated act that is grounded in, and not separated from, a socially, culturally, and historically constructed world. Brown and Duguid [2001, p. 201] claim that "what individuals learn always and inevitably reflects the social context in which they learn it and in which they put it into practice." As a result, "knowledge belongs to communities" [McDermott, 1999, p. 108], and "what is learned is profoundly connected to the conditions in which it is learned" [Brown and Duguid, 1991, p. 48]. It is an organization's social, cultural, and historical context that shapes the worldview of organizational members and frames their interactions, through which they jointly interpret their environment and create new knowledge, leading to organizational learning.

In addition to the perspective that sees organizational learning as a situated collective knowledge creation process, we further highlight the generally accepted practices that catalyze organizational knowledge creation—the access to diverse knowledge sources across boundaries and the formation of informal network connections. Tushman and Scanlan [1981] indicate that when an individual has access to diverse knowledge sources, it will be easier for him/her to acquire useful knowledge when needed. Furthermore, new ideas are also more likely to be identified or generated out of interactions among individuals with diverse knowledge, as Brown and Duguid [1998, p. 97] note, "New knowledge often requires new forms of evaluation," and McDermott [1999, p. 110] puts it, "new ideas emerge in the conflict of perspective, the clash of disciplines." This is the so-called "creative abrasion" process [Leonard and Sensiper, 1998]. Cohen and Levinthal [1990] pointed out that the increase of employees' access to diverse knowledge sources will augment one's capability to make novel linkages and associations, resulting in increased organizational absorptive capacity. Fichman and Kemerer [1997] also argued that the knowledge barrier to innovate is lower for organizations with greater diversity of technical knowledge.

In an organization, informal networks connect employees across functions and divisions through personal and social relationships [Awazu, 2004; Cross and Prusak, 2002; Krackhardt and Hanson, 1993]. Powell, Koput, and Smith-Doerr, 1996, p. 120 claim that a formal contractual exchange is just "the tip of the iceberg—it excludes dozens of handshake deals and informal collaborations.... Beneath most formal ties, then, lies a sea of informal relations." As a result, "the real work in most companies is done informally, through personal contacts" [Cross and Prusak, 2002, p. 105]. With regard to organizational knowledge creation processes, these informal relations supplement formal networks by enabling individuals to have access to different knowledge sources and to locate knowledgeable experts. Desouza [2003] found that informal networks foster the exchange of tacit knowledge. Hansen [1999] highlights the capability of the informal cross-boundary connections to acquire more diverse, useful, and less redundant knowledge. In addition, the extent to which an informal network spans different communities is found to

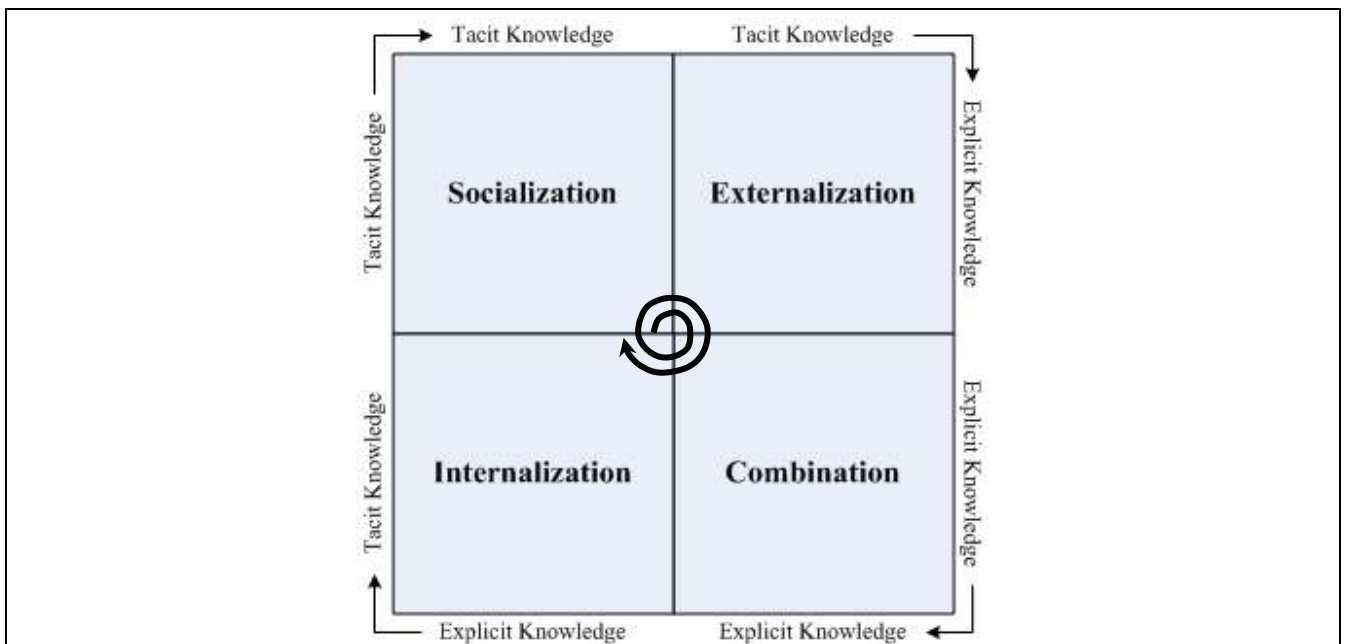
be positively associated with how easily diverse knowledge is transferred and interpreted [Reagans and McEvily, 2003]. Research has also shown the significance of different sources of knowledge across which informal networks span, such as different units of the an organization (e.g., Kostova and Roth, 2003), different organizations (e.g., von Hippel, 1988), and between an organization and its customers (e.g., Nambisan, 2002), in organizational learning.

In our conceptualization of the framework of Web 2.0-driven organizational learning, the focus is on the informal connections that emerge out of the use of Web 2.0 applications, and we do not take into consideration formally initiated projects in which individuals communicate through Web 2.0 applications. This is because, as we emphasized above, informal relationships play a crucial role in organizational learning. McDermott [1999] makes this point clearer by claiming that most organizational knowledge resides in informal social interactions. As a result, investigations into how an organization learns requires a close look at the informal interactions among employees. Furthermore, in the literature on the organizational adoption of various Web 2.0 applications (e.g. Jackson et al., 2007; Millen, Feinberg, and Kerr, 2006), the formation of informal relationships and the resulting access to diverse knowledge sources have been identified as the most significant benefits. The goal of our proposed framework is thus to illustrate the capabilities of Web 2.0 applications to create informal connections within and across an organization, which will ultimately lead to facilitated organizational learning.

Our framework is built on the situated perspective of organizational learning, and it emphasizes the benefit of having access to diverse knowledge and forming informal networks. We adopt the SECI knowledge creation model, the concept of *Ba*, and social capital theory to create this framework in order to illuminate the linkage between the organizational use of Web 2.0 applications and organizational learning. In the rest of this section, we will briefly describe the SECI knowledge creation model, the concept of *Ba*, and social capital theory.

The SECI Knowledge Creation Model and the Concept of *Ba*

The SECI (Socialization, Externalization, Combination, and Internalization) knowledge creation model [Nonaka, 1994; Nonaka and Takeuchi, 1995; Nonaka et al., 2001] conceptualizes organizational learning as a process of continuous creation and conversion between tacit knowledge and explicit knowledge through interactions among individuals. Tacit knowledge is the aspect of knowledge that is highly personalized “know-how” and is difficult to codify and communicate [Polanyi, 1966]. Explicit knowledge, on the other hand, is codified and is readily transferable. The dynamic processes of organizational knowledge creation—the creation of tacit and explicit knowledge and their two-way conversions—are illustrated in this model as a spiral process composed of four stages: (S)ocialization, (E)xternalization, (C)ombination, and (I)nternalization [Nonaka, 1994; Nonaka et al., 2001] (see Figure 1).



OUP Material: THE KNOWLEDGE-CREATING COMPANY: HOW JAPANESE COMPANIES CREATE THE DYNAMICS OF INNOVATION by Ikujiro Nonaka & Hirotaka Takeuchi (1995) Figure 3.3 from p. 71 (adapted). By permission of Oxford University Press, Inc. (www.oup.com).

Figure 1. The SECI Knowledge-creation Model (adapted from Nonaka and Takeuchi, 1995, p. 71)

- **Socialization**—knowledge creation via the conversion of tacit knowledge to tacit knowledge. Tacit knowledge is shared and converted from one person to another as they interact through joint activities or shared practices.
- **Externalization**—knowledge creation via the conversion of tacit knowledge to explicit knowledge. In this process, tacit knowledge is de-contextualized through continuous, intensive “dialogue” to be made explicit. The resulting explicit knowledge becomes ready to be applied in different contexts.
- **Combination**—knowledge creation via the conversion of explicit knowledge to explicit knowledge. In this process, explicit knowledge from various sources are combined and exchanged. This reconfiguration of explicit knowledge through sorting, adding, re-categorizing, and re-contextualizing creates new and meaningful explicit knowledge.
- **Internalization**—knowledge creation via the conversion of explicit knowledge to tacit knowledge. Organizational activities such as learning-by-doing and training exercises help the embodiment of the explicit knowledge into individuals’ daily practices.

The spiral processes of this model depict the incessant conversion between tacit and explicit knowledge through continuous interaction among individuals, in which organizational learning is embedded. The conversion from tacit to explicit knowledge enables the combination and reconfiguration of new knowledge. The conversion of explicit to tacit knowledge creates a new shared mental model and a new set of technical skills among individuals—a broader context—which allows them to engage in further knowledge creation and conversion.

Recognizing that knowledge is context-specific and relational, Nonaka and Konno [1998] further introduce the concept of *Ba* to describe the context in which knowledge is shared and co-created. Nonaka and Konno [1998] describe that *Ba* is a shared space—physical, virtual, mental (experiences, ideas, cultures, etc.), or any combination of them, which is dynamically created through interaction as the platform for the processes of knowledge creation and conversion. Nonaka and Toyama [2003, p. 6] claim that “the knowledge-creating process is necessarily context-specific in terms of time, space, and relationship with others.” *Ba* is the context that harbors meaning and knowledge needs *Ba*, a context, in order to exist [Nonaka et al., 2001].

According to Nonaka and Konno [1998], Nonaka et al. [2001], and Nonaka and Toyama [2003], *Ba* is not necessarily a physical or virtual space. *Ba* as the context for knowledge creation can also be conceived as an interaction itself that is formed dynamically with the participation of individuals. This dynamic interaction brings together knowledgeable resources at a certain time and space, forming the *Ba*. When knowledge is shared, re-created, and amplified out of interaction, *Ba* is also re-created, resulting in a new context for further interaction and knowledge creation. In this regard, *Ba* is a continuous generative mechanism [Nonaka and Toyama, 2003].

In the context of organizational Web 2.0 use, *Ba* is dynamically created as individuals start to interact through Web 2.0 applications. This emerging *Ba* comprises the virtual space provided by Web 2.0 applications (such as blog posts, Facebook walls, and Wiki entries), the social relationships of interacting individuals, and their experiences and mental models. In this *Ba*, users interact to share and create context-dependent knowledge. Given their informal and boundary-breaking nature, Web 2.0 applications can be expected to help create various *Bas* dynamically and reach different parts of an organization, or even extend beyond organizational boundaries to reach to customers and/or other organizations, whereby new knowledge can be created. This perspective is reflected in Nonaka and Toyama’s [2003, p. 8] claim that “*Ba* is not limited to the frame of a single organization but can be created across the organizational boundary.” Based on this perspective, an organization is not a fixed structure with formal horizontal and vertical boundaries, but a dynamic, organic configuration of various overlapping *Bas* where people interact with each other and create knowledge [Nonaka and Toyama, 2003].

With regard to the relationship between the concept of *Ba* and the SECI knowledge creation model, Nonaka and Konno [1998] and Nonaka et al. [2001] stress the importance of the formation of four specific types of *Ba* in order to facilitate knowledge creation. Each of these four types of *Ba*—originating *Ba*, dialoguing *Ba*, systemizing *Ba*, and exercising *Ba*—supports a distinct stage of knowledge creation and conversion [Nonaka and Konno, 1998].

- *Originating Ba* is the space that enables and supports the knowledge socialization process. Originating *Ba* is the world in which one sympathizes or empathizes with others, embraces the differences between each other, thereby removing the barrier between one’s self and others. In originating *Ba*, individuals interact to share tacit knowledge—their feelings, emotions, experiences, and mental models.
- *Dialoguing Ba* is the space that supports the knowledge externalization process. In dialoguing *Ba*, individuals’ mental models and skills are converted into common terms and concepts through dialogue and

reflection. In other words, Dialoguing *Ba* supports an individual's self-transcendence to synthesize diverse contradicting mental models of group members into a shared whole.

- *Systemizing Ba* is the space that supports the knowledge combination process. In systemizing *Ba*, new systematic explicit knowledge is created collaboratively by combining various sources of explicit knowledge. Systemizing *Ba* supports the access to various explicit knowledge sources and facilitates collaboration among community members.
- *Exercising Ba* is the space that supports the knowledge internalization process. In exercising *Ba*, individuals interact as they exercise their explicit knowledge in everyday practice and engage in internalization processes. As new knowledge is internalized into individuals' practices, a new *Ba* is created as the broader context for further socialization.

To summarize, in the SECI knowledge creation model, organizational learning is a spiral of knowledge creation and conversion processes. This spiral is enabled by continuous interactions among individuals of different origins, inside and outside of an organization, and is supported by the four specific *Bas*—originating *Ba*, dialoguing *Ba*, systemizing *Ba*, and exercising *Ba*. The exploration of how Web 2.0 applications facilitate organizational learning, therefore, requires an examination on how these applications enable the creation of the four specific types of *Ba*.

Social Capital

Social capital [Bourdieu, 1986; Burt, 1992; Coleman, 1988; Nahapiet and Ghoshal, 1998; Putnam, 1995] refers to resources, such as trust, social engagement, and norms of reciprocity, embedded within social relationships. In contrast to other kinds of capital that is tangible and held by individuals, such as physical capital and financial capital, social capital is intangible and resides in relationships. It is argued that the formation and existence of social capital privileges connected partners to share some benefits [Adler and Kwon, 2002; Nahapiet and Ghoshal, 1998]. The concept of social capital provides a theoretical perspective for examining various social phenomena. For example, Putnam [1995] studied the connection between civic participation in community and the performance of the government and social institutions. Coleman [1988] discussed the positive relationship between social capital, within the family or the community, and the formation of human capital. Burt [1992] explored how the existence of social capital allows access to privileged information and control over others. Wellman, Haase, Witte, and Hampton [2001] studied the Internet use and its effect on the formation of social capital. Social capital has also been applied to the study of numerous organizational phenomena. For instance, Nahapiet and Ghoshal [1998] discussed the different aspects of social capital and their effect on organizational knowledge creation. Inkpen and Tsang [2005] used social capital theory to examine different types of inter-firm relationships and discussed the conditions that facilitate knowledge transfer across these relationships. Yli-Renko, Autio, and Sapienza [2001] studied and identified that the formation of social capital between young technology-based firms and their customers leads to the facilitation of knowledge acquisition and creation.

In this article, we base our proposed framework on Nahapiet and Ghoshal's [1998] study of social capital to explore the relationship between the formation of social capital over Web 2.0 applications and organizational knowledge creation. Nahapiet and Ghoshal [1998, p. 243] define social capital as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit." These authors discussed the properties of social relations within an organization from the perspective of social capital and linked these properties to the creation of new knowledge through knowledge combination and exchange. In their conceptualization, organizational knowledge creation is the benefit embedded within social relations, which are characterized by three dimensions of social capital—structural, relational, and cognitive [Nahapiet and Ghoshal, 1998]:

- The structural dimension concerns the existence of social interaction ties and the structural pattern of the connections among social actors.
- The relational dimension concerns the development and maintenance of interpersonal relationships and the assets created in these relationships, such as trust, social norms, obligations, and identity.
- The cognitive dimension concerns the "shared representations, interpretations, and systems of meaning among parties" [Cicourel, 1973, quoted in Nahapiet and Ghoshal, 1998, p. 244]. This dimension is manifested as shared mental models, language, narratives, and vision [Chiu et al., 2006], or in Grant's [1996] term, "common knowledge," among individuals.

Nahapiet and Ghoshal [1988] propose that the existence of the three dimensions of social capital facilitates organizational knowledge creation. Chiu et al. [2006] also demonstrate that social capital increases the quality and quantity of knowledge transfer. In this regard, the structural, relational, and cognitive dimensions of social capital form the necessary context for the creation of knowledge. Therefore, we argue that the three dimensions of social

capital construct what Nonaka and Konno [1998] call “*Ba*,” within which processes of knowledge creation are embedded.

In this study, we link social capital theory, the SECI knowledge creation model, and the concept of *Ba* to be the conceptual foundation for our framework of Web 2.0-driven organizational learning. In the next section, we combine these theoretical perspectives to show how the organizational use of Web 2.0 applications allows the three dimensions of social capital to emerge and to manifest themselves as *Ba*, which, in turn, unfolds the knowledge creation spiral.

III. WEB 2.0 USE AND ORGANIZATIONAL LEARNING—TOWARD A FRAMEWORK

Web 2.0 brings liberation to the Internet. Web 2.0—whether it is conceptualized by researchers and practitioners as principles such as “the web as platform” and “harnessing collective intelligence” that characterize Web applications and services [O’Reilly, 2005], a platform upon which applications and services can be built [MacManus, 2005], an attitude which is about enabling participation [Davis, 2005], or a philosophy [Hoegg, Martignoni, Meckel, and Stanoevska-Slabeva, 2006]—is all about the change in end-users’ online experiences. Web 2.0 applications, be it collaborative content creation (Wiki or Google Doc), Web publishing (Blog), social networking (Facebook or MySpace), social bookmarking (Del.icio.us), and online content subscription (RSS), are helping shift the online world from aristocracy to democracy. In this shift, grassroots—the long tails [Anderson, 2004; O’Reilly, 2005]—change from forbidden to participating, from isolated to connected, and from deprived to empowered. At the age of Web 2.0, the online environment becomes an “architecture of participation”—an architecture with an open nature and low barriers to use [Anderson, 2007], and an architecture in which Web 2.0 services will automatically get better as more people use them [O’Reilly, 2005]. As a result, the Web contents are no longer centralized; instead, Web 2.0 users have the power to select, aggregate, edit, and connect Web contents in their own way, through which their voices are heard, they are connected, they interact, and they collaborate. The ability of Web 2.0 applications to allow users to participate, to connect, and to create contents collectively is why the Web services and applications that feature Web 2.0 characteristics are also called “social software” [Shirky, 2003]. That is also the reason why scholars and practitioners of various fields are so enthusiastic about this “new version” of the Web (e.g., Anderson, 2007; Franklin and van Harmelen, 2007; Kamel Boulos and Wheelert 2007; Miller, 2005; O’Reilly, 2005).

In the business domain, Tredinnick [2006, p. 232] claims that Web 2.0 applications benefit businesses through their “ability to capitalize on the knowledge and information within an organization.” Brynjolfsson and McAfee [2007] call Web 2.0 applications “meta-innovation”—innovation that is used to drive innovation through its ability to create an architecture of participation within an organization. The “architecture of participation” that Web 2.0 applications presages is what Brynjolfsson and McAfee [2007, p. 51] call “the ground rule of the game,” which drives managers to introduce Web 2.0 applications into organizations in order to bring liberation to the business intranet and to leverage the “wisdom of crowds” and foster organizational learning [Surowiecki, 2004]. We can see this trend in Levine’s [2008] report where 32 percent of 2,081 surveyed companies said they were currently using or would be using Web 2.0 applications within twelve months. A series of surveys conducted by McKinsey & Company also indicate that there is an increasing number of companies adopting Web 2.0 applications and, for each company, the number of adopted Web 2.0 applications is also rising [Bughin and Manyika, 2007; Bughin et al., 2008]. The consequences of organizational adoption can be clearly seen by reviewing recent studies on the organizational use of various Web 2.0 applications, including social networking sites [DiMicco and Millen, 2007; DiMicco, Millen, and Geyer, 2008; Skeels and Grudin, 2009], social bookmarking sites [Damianos, Griffith, and Cuomo, 2006; Damianos, Cuomo, Griffith, Hirst, and Smallwood, 2007; Millen et al., 2006], blogs [Huh, Erickson, Kellogg, Bellamy, and Thomas, 2007; Jackson et al., 2007], and wikis [Majchrzak, Wagner, and Yates, 2006]. These studies unanimously reported that Web 2.0 applications benefit organizations through their capability of facilitating the creation of informal communities, in which employees have better access to experts, their social networks are extended, social capital is built up, and knowledge transfer is facilitated. The McKinsey global survey results further showed that 69 percent of nearly 1,700 executives from different industries claimed that their companies have gained benefits, including more innovative products and services, better access to knowledge, etc., from the adoption of Web 2.0 applications [Bughin et al., 2009].

If Web 2.0 applications, when introduced into organizations, are expected to foster organizational knowledge sharing and, ultimately, to drive organizational learning, then what is the mechanism that leads to this potential? There are some initial efforts at answering this question. For example, Huang et al.’s [2010] model shows that Web 2.0 applications facilitate organizational innovation through their ability to enable knowledge transfer across organizational units. Treating Web 2.0 applications as learning tools, Boateng et al.’s [2009] framework explains how the use of various Web 2.0 applications within an organization facilitates the processes of organizational knowledge creation. Despite these nascent efforts, there is not yet a comprehensive theoretical framework that explains the mechanisms underlying this organizational phenomenon.



In order to understand the relationship between Web 2.0 applications and organizational learning, we first need to know the characteristics of Web 2.0 applications. Web 2.0 principles highlighted by Kim et al. [2009] provide such insight. Kim et al. [2009] conceptualize Web 2.0 as an umbrella term covering different *technologies*, *principles*, and *applications*. According to these authors, the fundamental Web 2.0 *principles* that are driven by Web 2.0 *technologies*, such as Ajax (Asynchronous JavaScript), XML (Extensible Markup Language), and Flash, frame our everyday use of Web 2.0 *applications*. These Web 2.0 principles are:

- Participation: Web 2.0 lowers the barriers to use Web applications in order to facilitate participation.
- Collaboration: Web 2.0 fosters the collaboration on the creation of Web contents.
- Social Networking: Web 2.0 makes users easier to build and maintain of social connections.
- Rich User Interface: Web 2.0's capability to deliver highly interactive user interfaces and multimedia enriches users' online experiences.

Next, we need a conceptual link that connects these principles to user knowledge-creation activities. The remaining part of this section shows our effort to build up a framework that conceptualizes this link, in which social capital theory, the SECI knowledge creation model, and the concept of *Ba* are cohesively connected. In this framework, the dimensions of social capital help to explore in depth the types of connections that emerge out of Web 2.0 use, the quality of the relationships among connected users, and the shared mental model, language, and vision among them. The concept of *Ba* ties social capital theory to the SECI knowledge creation model, specifying the socio-technological conditions whereby knowledge-creation activities are supported. The SECI knowledge creation model, then, explains how Web 2.0 use leads to the knowledge creation processes of socialization, externalization, combination, and internalization. These theoretical concepts, when tightly linked together, depict the framework of Web 2.0-driven organizational learning. To elaborate more on this idea, in the next subsection, we first examine, from the perspective of the dimensions of social capital, the emerging relations among Web 2.0 users when they start to use Web 2.0 applications. Table 1 and Figure 2 summarize this examination.

Table 1: The Examination of the Emerging Relations out of Web 2.0 Use from the Perspective of the Dimensions of Social Capital				
Social Capital Dimensions	Type of emerging relations			
	Intra-Unit	Inter-Unit	Inter-Organization	Organization-Customer
Structural Dimension	Information Brokers	Boundary Spanners	Boundary Spanners	Boundary Spanners
Relational Dimension	Strong ties	Weak ties	Weak ties	Weak ties
Cognitive Dimension	Highly shared mental model, understanding, language	Moderately shared mental model, understanding, language	Minimally shared mental model, understanding, language	Minimally shared mental model, understanding, language

The Creation of Social Capital Through the Organizational Use of Web 2.0 Applications

The Structural Dimension of Social Capital

As social software, Web 2.0 applications enable the formation of informal virtual groups that connect users with different backgrounds and from various locations across boundaries [Alexander, 2006; Shirky, 2003]. In organizations, these emerging informal relations can thus be expected not only to connect employees of the same organizational unit but also to transcend formal boundaries and reach employees of different units, employees of different organizations, and customers [Chui, Miller, and Roberts, 2009; Lindmark, 2009; Bughin and Manyika, 2007; Bughin et al., 2008; Seo and Rietsema, 2010]. As a result, from the perspective of the structural dimension of social capital, the organizational use of Web 2.0 applications creates these four types of informal connections among Web 2.0 users.

The informal and boundary-crossing features of Web 2.0 applications, when adopted within an organization, are supposed to result in two main types of brokerage roles that facilitate the flow of knowledge. Just as brokers are intermediaries who facilitate transactions or resource flows between actors lacking access to or trust in one another [Gould and Fernandez, 1989; Marsden, 1982], these two types of knowledge brokerage roles facilitate the flow of

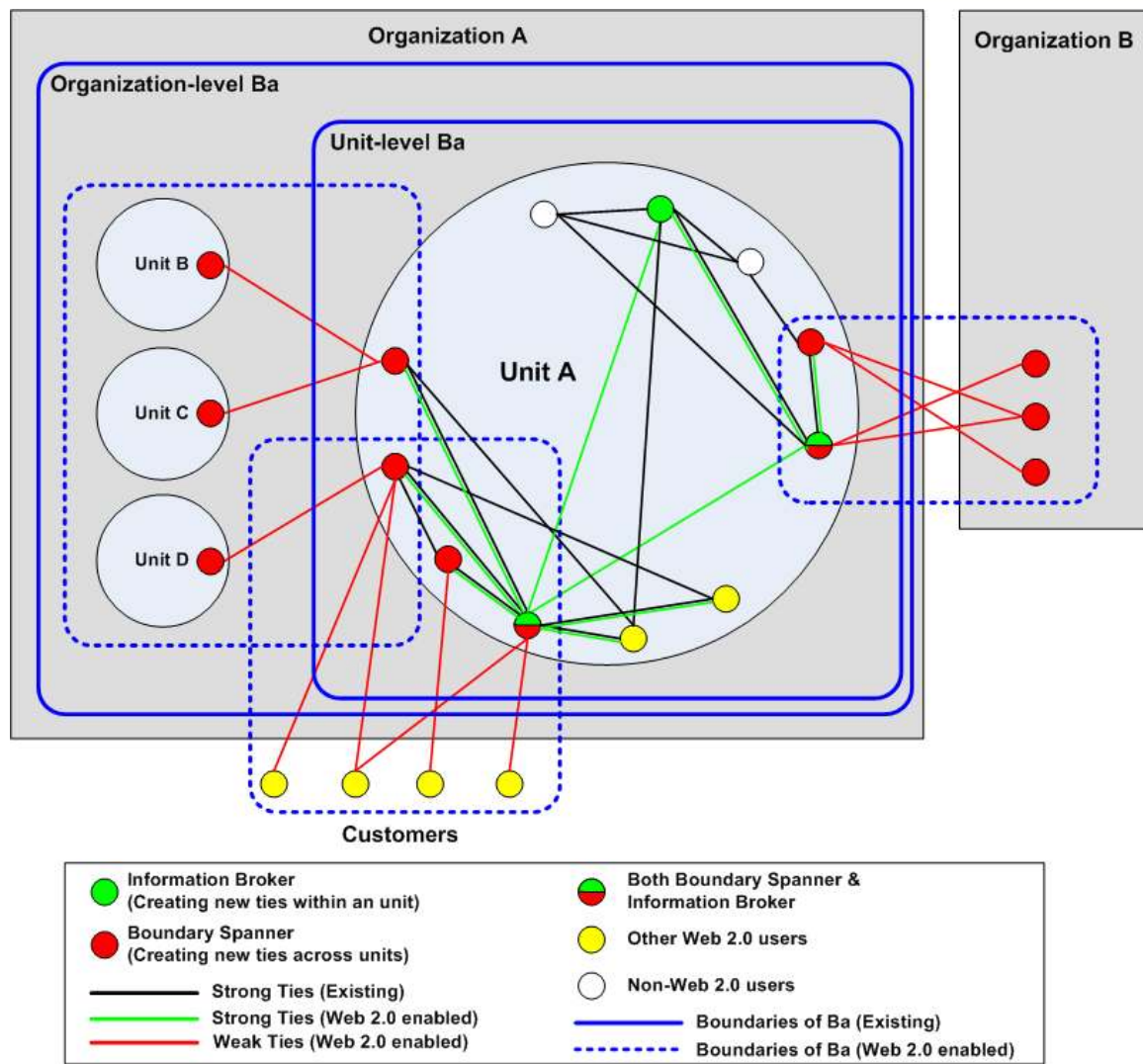


Figure 2. The Examination of the Emergent Relations out of Web 2.0 Use from the Perspective of the Dimensions of Social Capital

knowledge between otherwise disconnected parties.¹ The Web 2.0 users connecting to others outside the formal boundaries of organizational units will enact the brokerage role of boundary spanners, who allow the identification, collection, filtering, and dissemination of knowledge from outside an organizational unit to the members of the unit [Aldrich and Herker, 1977; Cross and Prusak, 2002; Tushman and Scanlan, 1981]. These users act as mediators between members within the same boundary and the outside environment. According to Cohen and Levinthal [1990], boundary spanning roles enable organizations to adapt to environmental change and increase their absorptive capacity—the “ability to recognize the value of new information, assimilate it, and apply it to commercial ends” [p. 128]. The other knowledge brokerage role enacted by Web 2.0 users is to informally bridge subgroups of the same organizational unit in order to facilitate knowledge transfer across the unit. This role is called “local broker” [Gould and Fernandez, 1989] or “information broker” [Cross and Prusak, 2002]. The main function of information brokers is to act as mediators for members of a community. An example of this role, given by Gould and Fernandez [1989], is the Federal Reserve Bank in a major city. Through the information broker, private banks in this city are able to transact and communicate with each other. Information brokers unify subgroups of a community as a whole, and every member of a community is able to reach others within the same community through this role [Cross and Prusak, 2002]. Information brokers, therefore, help the coordination of communication across the community and facilitate the flow of knowledge among community members. Information brokers play a role similar to that of boundary spanners, only they do it within the community [Cross and Prusak, 2002]. As can be seen in Figure 2,

¹ Following the argument made by Gould and Fernandez [1989, p. 91], we use the term *brokerage role* here in the sense that these brokers do not necessarily attempt to extract rewards out of their brokering activities.

cross-boundary relationships over Web 2.0 applications enact the boundary-spanning role. Information brokers, on the other hand, bridge sub-groups of a unit by creating new ties within the unit.

The two main brokerage roles enacted out of Web 2.0 use work together to foster the transfer of external diverse knowledge into internal use. Boundary spanners act as the organizational unit's eyes and ears in the wider world [Cross and Prusak, 2002], recognizing outside knowledge and transferring it into a unit. Information brokers, then, help the dissemination of internal or external knowledge to members of an organizational unit. When an individual interacts with others both within and outside of his/her unit through Web 2.0 applications, s/he acts simultaneously as a boundary spanner and an information broker.

The Relational Dimension of Social Capital

The relational dimension of social capital concerns the quality of relationships among connected individuals and the formation of social resources, such as trust and norms, through such relationships. This "degree of intimacy" in which people are related and its effects can be captured by the concept of strong ties and weak ties [Granovetter, 1973]. Strong-tie relationships connect those who communicate frequently, express higher emotional intensity and mutual confidence, and share norms of reciprocity. Weak ties, on the other hand, are maintained by those who communicate less frequently, with low emotional intensity and mutual confidence, and do not share norms of reciprocity. While strong ties are good at providing social and emotional support and solving conflict [Hansen, 1999], weak ties facilitate information transfer [Granovetter, 1973].

Previous studies have shown that the organizational use of Web 2.0 applications creates weak-tie connections among users (e.g., Jackson et al., 2007) to foster the flow of new ideas. The focus of these studies, however, was on how cross-boundary relationships, such as employees of different organizational units, emerge through Web 2.0 use. According to Blanchard and Horan [1998], physically based virtual communities may contribute to denser social networks and increased social capital. For Web 2.0 users of the same organizational unit with existing relationships, their use of Web 2.0 applications, thus, is expected to enhance their existing and already strong ties, resulting in higher trust and shared norms among them. Therefore, we propose that the organizational use of Web 2.0 applications creates weak-tie relationships across the boundaries of an organizational unit and strong-tie relationships within these formal boundaries. Through the weak-tie connections created by the use of Web 2.0 applications, knowledge transferred will be more diverse, useful, and less redundant [Burt, 1992; Hansen, 1999]. These applications also enhance strong ties among users of the same organizational unit and facilitate problem solving, task coordination, and social engagement [Hansen, 1999; Krackhardt and Hanson, 1993].

Indeed, in real-world practices, there are cases when the informal, boundary-crossing relationships out of Web 2.0 use are created upon preexisting formal relationships, such as organizational alliances or cross-boundary teams [Inkpen and Tsang, 2005; Powell et al., 1996], leading to more intimate relationships. On the other hand, relational conflicts also exist within boundaries [Jehn, Northcraft, and Neale, 1999; Simons and Peterson, 2000], weakening formal or informal relationships therein. Our simplification of the organizational dynamics is to make the conceptualization of the proposed framework more manageable and to focus more on the theoretical synthesis. The proposed framework can still be readily extended to different relational settings. The condition for knowledge creation—*Ba*, the theoretical foundation of our framework—is emergent, dynamic, and boundary-crossing, thereby making our framework conceptually flexible, capable of explaining various configurations of knowledge creation environments.

The Cognitive Dimension of Social Capital

The cognitive dimension of social capital concerns the shared understanding, language, mental models, and vision among connected individuals. According to the situated knowledge perspective, contextual differences such as different practice, geographic environment, technologies, and/or cultures engender different thought worlds and ways of interpretation [Brown and Duguid, 2001; Cramton, 2001; Dougherty, 1992; Hinds and Bailey, 2003]. Consequently, when Web 2.0 applications connect users of the same organizational unit, across organizational units, across organizations, or between the organization and its customers, these connected Web 2.0 users should have varying degrees of sharedness of mental models, language, and understanding. In other words, the cognitive distances [Cillo, 2005; Nootboom, Van Haverbeke, Duysters, Gilsing, and van den Oord, 2007], resulting from contextual differences, among Web 2.0 users should get wider when these users do not belong to the same organizational unit or do not even belong to the same organization. This lack of common knowledge [Grant, 1996, Reagans and McEvily, 2003] among Web 2.0 users across boundaries is one of the main barriers to communicating knowledge [Cramton, 2001; Szulanski, 1996]. As a result, we argue that when connections emerge among Web 2.0 users of the same organizational unit, their shared context should provide these users with a highly shared language, understanding, and mental models. Web 2.0 users who are from different organizational units are expected to share their mental models, language, and understanding to some extent, because they are employees of the same organization, sharing the same organizational culture and visions. In instances where Web 2.0

applications connect employees of an organization to employees of different organizations or to customers, their wider cognitive distances should make these users less likely to have much overlap in their mental models, language, and understandings. Exceptions to this situation exist. For example, Brown and Duguid [1991, 1998, 2002] stress that common practices among knowledge sharers will result in “leaky” knowledge across organizational boundaries. In addition, when different units, different organizations, or the organization and its customers are co-located in the same geographical area, the shared location-specific knowledge can be helpful for these boundary-crossing Web 2.0 users to communicate [Sole and Edmondson, 2002].

In this subsection, we used the lens of the three dimensions of social capital to examine the characteristics of the four types of relations that can emerge out of Web 2.0 use. As will be discussed in the next subsection, the differences between these relation types in terms of the dimensions of social capital will affect the difficulty of creating the four specific *Bas* by Web 2.0 users. Based on this examination of the emerging relationships, we claim that when individuals create social capital within Web 2.0 virtual spaces, they actually create the context—the *Ba*—where knowledge-creation activities could happen. In other words, we argue that the emergence of dimensions of social capital—structural, relational, and cognitive—collectively form the *Ba* in which knowledge-creation activities can be stimulated. Nonaka and Konno [1998] and Nonaka et al.’s [2001] explanation of *Ba* justifies this claim. These authors explain that *Ba* has different aspects: *Ba* is the place where knowledgeable people interact. It is the framework in which people get together as knowledge resources in a certain time and space. It can be seen as interactions through which individuals’ mental models, experiences, and understandings are brought together to form new knowledge. It also needs to be energized by trust, care, or commitment in order to enable knowledge-creation activities.

The use of Web 2.0 applications provides the virtual space where Web 2.0 users interact. This corresponds to the aspect of *Ba* as shared place. The structural dimension of social capital underlines the existence of connected knowledgeable individuals who are brought together through Web 2.0 use in a certain time. This corresponds to the aspect of *Ba* as framework. The cognitive dimension of social capital underlines the degree of sharedness in mental models, understandings, and language between Web 2.0 users. This corresponds to the aspect of *Ba* as interactions that bring together individuals’ mental models, experiences, understandings, and languages. The relational dimension of social capital concerns the existence and formation of trust and shared norms among Web 2.0 users. The existence of trust and norms energizes the *Ba*. To summarize, when Web 2.0 users within or across organizational boundaries start to meet, different aspects of *Ba*—the Web 2.0 virtual space and the dimensions of social capital—emerge. We call this emerging *Ba* the “basis *Ba*.” Our examination above shows that, depending on the types of relations that Web 2.0 applications create, basis *Bas* of different characteristics are created.

In the next subsection, we link the Web 2.0 principles, social capital theory, the SECI knowledge creation model, and the concept of *Ba* into a conceptual framework of Web 2.0-driven organizational learning. In this conceptualization, the basis *Ba* that emerges through Web 2.0 use is not necessarily ready for knowledge creation. It is through continuous interaction that social capital among Web 2.0 users increases to support knowledge-creation activities. This idea can be conceptualized as the basis *Ba* gradually evolving into the four specific types of *Ba*—originating *Ba*, dialoguing *Ba*, systemizing *Ba*, and exercising *Ba*—through interaction. Each of these specific *Bas* then facilitates a distinct stage of the knowledge creation spiral—socialization, externalization, combination, and internalization. The idea of the creation and evolution of *Ba*—the formation of *Ba* and its use as the basis to create a broader *Ba*—is the key to the processes of knowledge creation [Nonaka et al., 2001].

The Framework of Web 2.0-Driven Organizational Learning

Our proposed framework of Web 2.0-driven organizational learning is based on social capital theory, the SECI knowledge creation model, and the concept of *Ba* (see Figure 3). In this framework, the knowledge creation spiral is enabled and supported through the four types of *Ba*—originating *Ba*, dialoguing *Ba*, systemizing *Ba*, and exercising *Ba*. In the organizational use of Web 2.0 applications, these specific *Bas* evolve from the basis *Ba*, which is composed of the Web 2.0 virtual space and the emerging social capital among Web 2.0 users. Since the organizational use of Web 2.0 applications creates social capital of various characteristics, depending on the types of relations between users, we argue that the difficulty of creating the four types of *Ba* via each of these relation types should vary. In this subsection, we will discuss the four stages of the SECI knowledge creation model in the context of the organizational use of Web 2.0 applications. Our objective here is to show how the social capital that emerges from Web 2.0 use increases and evolves into the four specific types of *Ba* that lead to successful knowledge-creation activities.

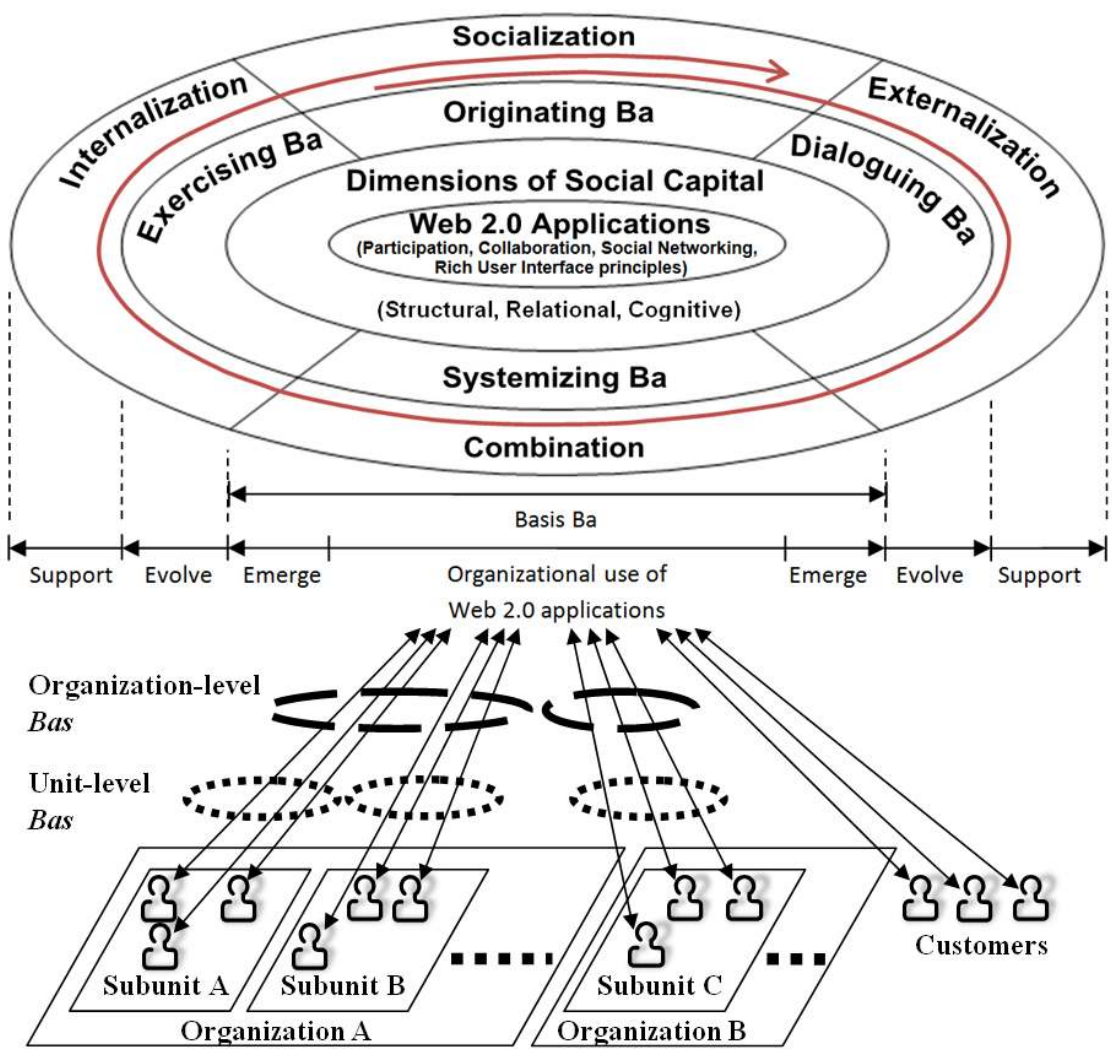


Figure 3. The Framework of Web 2.0-driven Organizational Learning

Socialization

The socialization stage of knowledge creation begins when people start to interact to exchange personal tacit knowledge. At this stage, originating *Ba* needs to be created by Web 2.0 users to support the tacit knowledge conversion process. Chan and Liebowitz [2006, p. 22] claim that to share tacit knowledge, “a direct tie with the knowledge source(s) must be established and trust must be built.” According to Nonaka and Konno [1998] and Nonaka and Toyama [2003], tacit knowledge is acquired through shared experiences and joint activities such as spending time and being together. Levin and Cross [2004] also identified that a trusting relationship is critical for receiving useful tacit knowledge. The building blocks of originating *Ba* in which socialization occurs, as a result, are (1) the formation of direct ties between tacit knowledge sharers, and (2) the existence of trust between them. Direct ties with others set up the prerequisite—being together—for tacit knowledge conversion. Trust between knowledge sharers enables one to transcend oneself to empathize with others and to embrace the contextual differences between one another [Lesser and Prusak, 1999; Nonaka and Toyama, 2003; von Krogh, 1998]. These two building blocks reflect the structural and the relational dimensions of social capital, respectively [Nahapiet and Ghoshal, 1998].

The principles of Web 2.0 applications—participation and social networking—make it easier for the users to establish informal direct relationships with other users within or across boundaries and involve in interaction. In addition, we argue that how easily trust—another building block of the originating *Ba*—can be developed among Web 2.0 users depends on the type of relation that Web 2.0 applications establish. As indicated above, emergent relations between Web 2.0 users of the same organizational unit are characterized by strong intimate ties. Levin and Cross [2004] claim that trust is more likely to occur among strong-tie connections. That is to say, the emerging relations among users of the same unit through Web 2.0 use are more likely to result in trusting relationships. It should thus not be

problematic for these users to create originating *Ba*, which would allow them to make sense of each other's experiences and to convert their tacit knowledge over Web 2.0.

In contrast, it may be somewhat difficult for employees of different organizational units to create originating *Ba* through Web 2.0 use. The generally weaker ties between these users make them less likely than users of the same organizational unit to have high levels of trust when the informal relationships are established over Web 2.0 applications. Without trust among knowledge sharers, it would be difficult for them to empathize with each other and embrace their contradiction, and they are also less willing to share their tacit know-how with others [Levin and Cross, 2004]. Still, being in the same organization enables these users to have the same organizational vision, organization-specific language, and organizational norms, which comprise their existing organization-level *Ba*. This helps the formation of trust among them to some extent. Tsai and Ghoshal [1998] point out that shared vision encourages the development of trusting relationships. Abrams et al. [2003] also emphasize the importance of shared vision and language in nurturing interpersonal trust within informal networks. More frequent interaction and collaboration, which can be facilitated through Web 2.0 use, also help in promoting interpersonal trust [Abrams, Cross, Lesser, and Levin, 2003; Jones and George, 1998].

When informal relations are built through Web 2.0 use between employees of different organizations or between employees and customers, these users can fail to create originating *Ba* in the beginning due to their weak, less intimate ties with low trust. The socialization stage of the knowledge creation spiral can thus be difficult to happen. Similar to the inter-unit interaction through Web 2.0 use, when these Web 2.0 users engage in interaction, shared vision and language, and thus trust among them will gradually be developed [Abrams, Cross, Lesser, and Levin, 2003], leading to the formation of originating *Ba*. Furthermore, when informally connecting to knowledge sources outside of an organization, if organizational users consider these weak-tie sources to provide useful knowledge, their perceived trust in the competence of customers and employees of different organizations should be higher [Levin and Cross, 2004]. This enables the creation of originating *Ba* to help these users absorb outside tacit knowledge [Levin and Cross, 2004].

While creating originating *Ba* across boundaries can be challenging, boundary spanners—the brokerage role that facilitates the transfer of diverse knowledge from the outside environment—play a critical role at this stage of knowledge creation.

Externalization

In the externalization stage of knowledge creation, tacit knowledge is converted into explicit knowledge. This conversion is triggered by successive rounds of meaningful dialogue, reflection, and the use of metaphor or analogy [Nonaka, 1994; Nonaka and Kunno, 1998; Nonaka et al., 2001; Nonaka and Toyama, 2003]. The successive dialogue between the connected peers helps them to confront and understand the contradictions of their respective contexts. This makes it possible for them to reflect upon, de-contextualize, and synthesize the contradictions so as to convert their tacit knowledge into explicit knowledge. Dialoguing *Ba* is the space to support these processes [Nonaka and Kunno, 1998].

The participation and collaboration principles embedded in Web 2.0 applications facilitate user engagement in interactive dialogue. The capabilities of these applications to create rich-user-experience interfaces also encourage the creation and use of metaphor and analogy. Web 2.0 applications thus provide the supportive platform to create dialoguing *Ba*. In addition to the supportive Web 2.0 applications, the difficulty of creating dialoguing *Ba*, that is, the difficulty of the synthesis of the contradiction among knowledge sharers, depends on the degree of overlap between their respective contexts [Alavi and Leidner, 2001; Cohen and Levinthal, 1990; Grant, 1996; Nahapiet and Ghoshal, 1998]. This degree of “common knowledge” among knowledge sharers and the corresponding difficulty in converting tacit knowledge reflect the cognitive dimension of social capital [Nahapiet and Ghoshal, 1998].

The lower the degree to which the knowledge sharers share their mental model, language, and vision, the higher the contradiction and the more difficult their dialogue to externalize knowledge will be. This is because their differing thought worlds make them view, interpret, and make sense of things differently [Dougherty, 1992] and, thus, make it difficult for them to comprehend each other's tacit knowledge and to convert it. This is why Brown and Duguid [1998] and von Hippel [1994] call the socially and contextually embedded knowledge as “sticky,” difficult to share across boundaries, and also why Cohen and Levinthal claim that “learning is more difficult in novel domains” [1990, p. 131]. As a result, when it comes to the boundary-crossing relationships through Web 2.0 use, more iterations of meaningful dialogue and metaphor use are needed in order to successfully bridge the contradictions and to make tacit knowledge explicit. Participating in real-time synchronous communication through Web 2.0 applications can also result in a faster buildup of common language among these users [Maruping and Agarwal, 2004]. For Web 2.0 users of different organizational units, their shared organizational vision and language contribute to the creation of dialoguing *Ba* to some extent. The knowledge conversion process can also be further facilitated if these users share

practices [Brown and Duguid, 1998, 2001] or are co-located [Sole and Edmondson, 2002]. On the other hand, when employees of the same organizational unit use Web 2.0 applications to connect to each other, they should not have difficulty in creating dialoguing *Ba* to externalize their tacit knowledge, given that the contradiction of their respective knowledge would be low. Their existing strong-tie connections provide them common ways of thinking [Levin and Cross, 2004]. Their shared context—mental model, language, understanding, and vision—also facilitate their dialoguing process to convert tacit knowledge to explicit knowledge. This is the situation when Cohen and Levinthal [1990] claim that sufficient level of knowledge overlap results in effective communication. The converted explicit knowledge is then ready to be combined with other de-contextualized explicit knowledge to form new knowledge in the combination stage of the knowledge creation spiral.

It should be noted that although higher cognitive distance among connected Web 2.0 users makes it difficult for them to synthesize their contradictions, such synthesis of diverse knowledge is necessary for sustaining organizational competitive advantage. As indicated earlier, the access to diverse knowledge sources contributes to organizational absorptive capacity and increases the possibilities of making novel linkages to innovate. In discussing the concept of *Ba*, Nonaka and Toyama [2003] point out that a good *Ba* is produced by participants of diverse contexts to bring in various viewpoints and to engage in dialogue and synthesize these contradictions. Web 2.0 applications provide the potential for participating, social networking, and collaborating among users across formal organizational vertical and horizontal boundaries. These interactions expose organizational users to diverse knowledge sources and allow them to engage in meaningful dialogue. This results in “good” dialoguing *Bas* to externalize tacit knowledge distributed across boundaries.

At this stage, boundary spanners again play an important role. They convert tacit diverse knowledge into explicit knowledge for internal use and for further knowledge combination.

Combination

Combination is the stage when explicit knowledge is integrated, synthesized, or reorganized with other explicit knowledge inside or outside the organization. Nonaka and Konno [1998] describe that successful combination of knowledge relies on three processes: (a) collecting and combining explicit knowledge inside or outside the organization; (b) dissemination of explicit knowledge to members of the same organizational unit; and (c) editing or processing of explicit knowledge to make it more usable. At this stage, systemizing *Ba* is created to support these processes of knowledge collection, dissemination, and organization among individuals. The trigger that makes these processes more efficient is the systematic coordination among team members [Nonaka, 1994].

The participative, collaborative, and social-networking nature of Web 2.0 applications facilitates the collecting, editing, and distributing of explicit knowledge from various sources. Nonaka et al. [2001, p. 500] also mention that the “combination of elements of explicit knowledge is most efficiently supported in a collaborative environment utilizing information technology.” Web 2.0 applications, therefore, provide a platform for knowledge combination to happen. The successful creation of systemizing *Ba* to trigger knowledge combination, then, lies both in the capability of Web 2.0 applications to facilitate the informal coordination tasks and in the capability of knowledge sharers to conduct informal coordination.

The knowledge-based view of an organization [Grant, 1996] suggests four mechanisms of knowledge coordination: coordination through rules and directives; coordination through organizational routines, coordination through formal meetings, and coordination through sequencing of tasks. Of these coordination mechanisms, the first three normally do not happen in an informal setting, as their names suggest. The sequencing of tasks—the assignment of time slots for each knowledge sharer to give his/her input independently, on the other hand, is possible to take place informally through the use of collaborative Web 2.0 applications such as Wiki.

In addition, Kijkuit and van den Ende [2010] claim that simply weak-tie relationships are not enough to effectively create knowledge out of diverse sources. It is through strong ties that the ambiguity and uncertainty of collected knowledge are able to be discussed and processed. Nahapiet and Ghoshal [1998] describe that shared language and codes enhance the knowledge combination capabilities of connected individuals. By citing Nonaka and Takeuchi [1995], Grant [1996, p. 116] also argues for the importance of common knowledge among knowledge sharers across organizational boundaries so that these individuals can “invade one another’s functional boundaries” for coordination to happen. In other words, apart from the capability of Web 2.0 applications to support the sequencing of knowledge combination tasks, common knowledge and strong relationships among knowledge sharers are also required to create systemizing *Ba* for an efficient coordination of combining knowledge.

For Web 2.0 users of the same organizational unit, systemizing *Ba* is readily created and knowledge combination tasks can be done informally without difficulty. They can informally combine knowledge through the sequencing of tasks. Their informal relationships can also supplement the existing formal relationships in the conduct of the above-

mentioned formal coordination mechanisms for knowledge combination—rules and directives, organizational routines, and formal meetings—by making the communication and the flow of knowledge more efficient. In the systemizing *Ba* that is created among Web 2.0 users of the same unit, external explicit knowledge is identified and collected by boundary spanners. With the collaboration of information brokers in the knowledge dissemination and coordination tasks, this external knowledge is combined and reorganized with internal explicit knowledge.

With respect to the remaining three types of informal relations created by Web 2.0 users, challenges exist in the creation of systemizing *Ba*. This is because the low degree of sharedness in mental models, language, and vision among these users, together with their weaker ties, inhibit their coordination of knowledge combination. It is only through continuous interaction that common knowledge is built up and intimate ties are gradually created, allowing these Web 2.0 users to engage in coordination. Still, Web 2.0 applications are limited in their ability to accommodate complex coordination tasks. According to Grant [1996], knowledge combination tasks that are highly complex can be coordinated only through more personal and communication-intensive forms of coordination, such as formal meetings. That is to say, unless formal knowledge combination tasks exist among these cross-boundary Web 2.0 users, the coordination of knowledge combination can be done only informally through sequencing tasks via Web 2.0 applications. In this case, only knowledge that is of lower complexity can be combined.

With the help of Web 2.0 boundary spanners and information brokers, the newly combined explicit knowledge can then either be freely spread among employees of an organization and be internalized into their practices or be further combined with other explicit knowledge.

Internalization

In the knowledge internalization stage, explicit knowledge is converted to tacit knowledge and is internalized in individuals' daily practices. The triggers to this conversion process are action and learning by doing, through which combined knowledge is applied, actualized, and embedded in individuals' practical situations [Nonaka, 1994]. At this stage, exercising *Ba* provides the necessary space for individuals' active participation in communicating and discussing knowledge and putting it into practice, thereby supporting the internalization process [Nonaka et al., 2001].

Web 2.0 applications encourage user participation, social networking, and collaboration. These applications also make heavy use of multimedia, Web technologies (such as Ajax), and Rich Internet Application (RIA) tools (such as Flash) to provide rich user Web experiences. In such an environment, Web 2.0 applications facilitate users' access, communication, and discussion of newly combined explicit knowledge. The synchronous/asynchronous communication and learning environment supported by Web 2.0 applications further allows users to be exposed to, reflect on, and make sense of acquired explicit knowledge, resulting in better application of the explicit knowledge in these users' practices [Alavi and Leidner, 2001]. In addition, Web 2.0 applications such as Second Life also provide simulation environments to support learning-by-doing processes. Through Web 2.0 applications, exercising *Ba* can be readily created, which leads to the internalization of explicit knowledge into daily practices.

Within exercising *Ba*, Web 2.0 users—who are boundary spanners and information brokers across an organization—work together to participate in the communication of explicit knowledge and to disseminate this knowledge to active or non-Web 2.0 users. The ideal case is that at the end of knowledge internalization, the new explicit knowledge will be shared and internalized among the employees of an organization, and this newly internalized knowledge will become part of the organizational knowledge base. This enhanced organizational knowledge base will broaden the employees' mental models and know-how. In other words, a broader organization-level *Ba* will be created. In this broader *Ba*, more socialization opportunities will arise, which continue the knowledge creation spiral.

These are the Web 2.0-enabled knowledge creation processes depicted by our proposed framework of Web 2.0-driven organizational learning. Nonaka [1994] indicated that companies that facilitate all four types of knowledge conversion by providing appropriate technological and organizational infrastructure are more likely to reap the benefits of new knowledge creation. With our proposed framework, we claim that the organizational use of Web 2.0 applications builds such a technological infrastructure to facilitate knowledge-creation activities. In this framework, the key step is the emergence of social capital through Web 2.0 use. The emerging structural, relational, and cognitive dimensions of social capital and the use of Web 2.0 applications create the shared space—the basis *Ba*—among Web 2.0 users. Through continuous interaction, the basis *Ba* gradually evolves into the originating, dialoguing, systemizing, and exercising *Bas*. These *Bas*, in turn, support the initiation and continuation of the knowledge creation spiral—Socialization, Externalization, Combination, and Internalization—and consequently, realize organizational learning.

IV. DISCUSSION

The framework we proposed here is founded on social capital theory, the SECI knowledge creation model, and the concept of *Ba* to present a conceptual link between the organizational use of Web 2.0 applications and organizational learning. In this framework, Web 2.0 applications provide the technological context in which learning takes place and the social capital among Web 2.0 users creates the social context. *Ba* is formed over these socio-technological contexts and evolves to support organizational knowledge creation. The dimensions of social capital provide a useful lens to review the capabilities of Web 2.0 applications to address various issues regarding organizational learning. For example, Brown and Duguid [1998, p. 100] cites Chesbrough and Teece's [1996] study to emphasize that "some competencies may be on the factory floor, some in the R&D labs, some in the executive suits." The key to organizational knowledge is to weave it all together." In our framework, this issue can be studied through the perspective of the structural dimension of social capital, which sees Web 2.0 applications as tools to create informal, boundary-crossing links. With respect to the relational dimension of social capital, in a review of work on organizational knowledge management, Alavi and Leidner [2001, p. 127] pose the research question "Can IT enhance knowledge creation by enabling weak ties to develop and by reinforcing existing close ties?" Our framework shows that Web 2.0 applications create weak ties across boundaries and enhance existing strong ties. Concerning the cognitive dimension of social capital, Cohen and Levinthal [1990] cite Simon [1985] and claim that "diverse knowledge structures coexisting in the same mind elicit the sort of learning and problem solving that yields innovation." Our framework also demonstrates that Web 2.0 applications allow access to diverse knowledge sources and facilitate the synthesis of diverse knowledge structures. Founded on the dimensions of social capital, our proposed framework depicts the potential of Web 2.0 applications to foster organizational learning.

The use of the concept of *Ba* in our framework helps us focus not only on the knowledge being created but also on the conditions that support knowledge creation processes. More specifically, *Ba* encompasses the dimensions of social capital and the Web 2.0 principles to facilitate the study of various socio-technological issues that support different stages of knowledge-creation activities. *Ba* also allows us to view an organization as an "organic configuration" of Web 2.0-enabled virtual communities [Nonaka and Toyama, 2003]. Inside the informal virtual world of Web 2.0 applications, an organization is a boundary-less social network, in which knowledge creation can be facilitated out of any configuration of within- or cross-boundary Web 2.0 users. By adopting the concept of *Ba*, our framework illustrates how the organizational use of Web 2.0 applications can create "conditions under which multiple individuals can integrate their specialist knowledge" [Grant, 1996, p. 112].

Theorizing on the potential of Web 2.0 to drive organizational learning also brings insights into the strategic implications of the organizational adoption of Web 2.0 applications. We argue that the organizational introduction and use of Web 2.0 applications enhance organizational dynamic capabilities [Eisenhardt and Martin, 2000; Teece et al., 1997]. Teece et al. (p. 516) define an organization's dynamic capabilities as its "ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments." Such ability is critical for the survival of an organization [Eisenhardt and Martin, 2000; Teece et al., 1997]. Our framework shows that Web 2.0 applications facilitate the socialization, externalization, combination, and internalization processes of knowledge creation to integrate, build, and reconfigure internal and external knowledge. These applications, therefore, enhance an organization's dynamic capabilities.

In addition, Teece et al. [1997] identify three dimensions of organizational competences that constitute an organization's dynamic capabilities: organizational processes/routines, current tangible/intangible assets, and evolutionary path. The use of Web 2.0 applications enables the knowledge creation spiral, which facilitates the knowledge transfer process, the knowledge coordination process, and, as a result, the organizational learning process. During this learning process, Web 2.0 applications allow organizations to constantly monitor the environment through the organization's informal connections with customers and other organizations. This results in "high-flex" organizations that are capable of making timely adjustments in response to environmental changes [Teece et al., 1997]. The organizational use of Web 2.0 also creates organizational assets. The creation of informal relations across formal boundaries through Web 2.0 use enhances an organization's structural assets, making the flow of knowledge easier [Teece et al., 1997]. The continuously created new knowledge through Web 2.0 use helps the accumulation of organizational knowledge assets. The creation of communication channels between an organization and its customers also supports the creation and growth of the organization's reputational assets [Teece et al., 1997]. Finally, the facilitated transfer of diverse knowledge and creation of new knowledge through Web 2.0 use boost and diversify an organization's evolutionary paths. Looking through the lens of these organizational competences, we see how the use of Web 2.0 applications enhances an organization's dynamic capabilities.

According to Eisenhardt and Martin [2000], in dynamic, "high velocity" markets, the ability to rapidly create situation-specific new knowledge determines an organization's dynamic capabilities. Web 2.0 applications help an organization to create constant informal relationships with the outside environment. This enables the organization to

continuously tap into outside knowledge of various sources and create new knowledge for any situation-specific purpose, sustaining the organization in high velocity markets. Moran and Ghoshal [1999, p. 409] argue that “it is not resources per se, but the ability to access, deploy, exchange, and combine them that lies at the heart of value creation.” Web 2.0 applications create opportunities for organizations to build up dynamic capabilities to access, deploy, exchange, and combine knowledge, leading to organizational value creation, that is, continuous organizational learning.

Research Implications

The framework of Web 2.0-driven organizational learning incorporates the theories of organizational learning and social capital to provide a cohesive conceptualization. This theoretical combination also encourages future investigations into the validation of this framework. For example, future studies can focus on the formation of informal relations inside or outside formal boundaries over Web 2.0 applications and their characteristics in terms of the dimensions of social capital. Questions such as how Web 2.0-enabled boundary spanners and information brokers interact and collaborate with each other; how boundary-crossing relationships can be built and maintained informally through Web 2.0 use; or how mutual trust, norms of sharing, and common knowledge can be formed and extended over Web 2.0 applications are of potential interest. In addition, the informal contribution of knowledge in terms of quality and quantity over knowledge management systems has been found to be positively affected by social capital among online users [Chiu et al., 2006; Wasko and Faraj, 2005]. Our framework also provides the social capital foundation for future studies on knowledge contribution in Web 2.0 environments. Many more questions posed in the literature are worth exploring. For example, how does the size of an organization affect its ability to learn informally over Web 2.0 applications [Almeida, Dokko, and Rosenkopf, 2003]? Do young organizations benefit more from the use of Web 2.0 applications to create external informal connections [Yli-Renko et al., 2001]? Will the “architecture of participation” that Web 2.0 promises truly happen inside the business intranet [Brynjolfsson and McAfee, 2007]? Will the use of different Web 2.0 applications affect the formation of social capital and the resulting knowledge-creation activities [Boateng, Malik, and Mbarika, 2009]? An even more important question to ask is, can the relationship between the organizational use of Web 2.0 applications and organizational knowledge creation be explained through our proposed framework?

The conceptualization of the dimensions of social capital as the building blocks of *Ba* advances the study of *Ba*, which plays a critical role in organizational knowledge creation but is empirically under-explored [Nonaka, von Krogh, and Voelpel, 2006]. We can study the formation, composition, expansion, and deletion of *Ba* through Web 2.0 use based on the dimensions of social capital. We also need future research on the evolution processes of the dimensions of social capital that lead to the creation of the four specific types of *Bas*—originating *Ba*, dialoguing *Ba*, systemizing *Ba*, and exercising *Ba*—over Web 2.0 applications. Future studies should examine the transition processes between each of the four specific *Bas* and/or their co-existence in Web 2.0 environments as well. The view of an organization as organic configuration of *Bas* further allows the investigation of the interaction between different within- or cross-boundary *Bas* over Web 2.0 applications—for example, the interaction between the *Ba* formed through an employee’s creation of relationships with customers via Web 2.0 applications and the existing unit-level *Ba* in which the employee works. In other words, how does the employee’s use of Web 2.0 applications affect his/her offline tasks?²

Future studies can also focus on each specific type of emerging relations through Web 2.0 use—intra-unit, inter-unit, inter-organization, and organization-customer relations. The framework we propose here can further the studies on consumer value co-creation [Nambisan, 2002] and on inter-organizational relationships [Inkpen and Tsang, 2005]. Web 2.0 applications create opportunities for knowledgeable experts outside an organization to contribute their expertise for the creation of knowledge within the organization. Our proposed framework can be used in combination with existing studies to explore the role that these external actors play, the creation and evolution of social capital among these actors, and the outcomes of their interactions in Web 2.0-enabled virtual environments.

Practical implications

Our framework also provides guidelines for organizations to design and implement Web 2.0 applications that meet their needs. According to this framework, managers and system designers should take into consideration three key aspects—social capital, stages of knowledge creation, and features of Web 2.0 applications—in system-design processes. The right combination of social capital and Web 2.0 applications creates the right *Ba* needed by the organization to support knowledge-creation activities. For example, if an organization focuses on the use of Web 2.0

² According to the conceptualization of Nonaka and Konno [1998], the exploration of the interaction between different *Bas* is the study of knowledge creation at the level of *Basho*. *Basho* concerns the combination of different *Bas* into a greater space, whereby knowledge created in the composing *Bas* also interact to create new knowledge in *Basho*. Nonaka and Konno [1998, p. 41] argue that “*Ba* is of fundamental importance for knowledge creation, and this creative process is amplified when all these *Ba* conjoin to form a *Basho*.”

applications to have constant, long-term relationships with specific customers, units, or organizations, then managers should specifically target the socialization stage of the knowledge creation spiral. In this case, they may introduce or design applications that support the creation of originating *Ba*—the space in which Web 2.0 users are able to form direct ties and trusting relationships. Web 2.0 applications that specialize in the participation and social networking principles (such as blog or social networking sites) can make this possible. On the other hand, the creation of dialoguing *Ba* should be the goal for an organization focusing on the continuous learning of latest knowledge from diverse sources—organizations of various industries, diverse customer bases, or organizational units across different countries. This will facilitate the dialogues among Web 2.0 users of these different groups to create a common knowledge base and to synthesize and externalize knowledge of diverse contexts. In addition, managers should emphasize more on the rich-user-interface functionalities of Web 2.0 applications to support the use of metaphor and analogies and help Web 2.0 users make sense of each other's knowledge. If the organizational focus is on the systematic integration of diverse knowledge, Web 2.0 applications specialized in informal collaboration will support the coordination of knowledge integration activities. Finally, Web 2.0 applications that provide simulation and collaboration environments will assist learning-by-doing activities and facilitate the communication, discussion, and reflection of knowledge for the application of explicit knowledge into offline practices.

Moreover, for the adoption or design of Web 2.0 applications capable of delivering quality knowledge, management should keep in mind that a successful information system project depends on more than a high-quality system [Delone and McLean, 1992]. Similar to many instances of failures in information systems adoption [Markus and Keil, 1994; McDermott, 1999], if top management introduces and treats Web 2.0 applications as a silver bullet, disappointment may soon follow [Bughin et al., 2008]. The anticipation that Web 2.0 applications will automatically lure people to contribute their expertise and to cooperate with each other is just a myth [McAfee, 2009]. Simply building up informal connections between organizational units is also not enough for organizations to benefit from cross-boundary knowledge sharing [McDermott, 1999; Hansen, 2002]. Our framework suggests that only through continuous interaction among Web 2.0 users can the four specific *Bas* be created and the knowledge-creation stages be supported. As a result, to achieve the full potential of Web 2.0 applications in organizations, management needs to focus more on people who use these applications, rather than on the system or needed knowledge source [McDermott, 1999], and take various actions to trigger the effective use of these applications.

First, the related prior knowledge among Web 2.0 users is crucial to identify, understand, and assimilate useful knowledge outside of unit and/or organizational boundaries [Anand, Glick, and Manz, 2002; Hansen, 2002]. As a result, it would be helpful to regularly rotate employees across different units, to train employees on required knowledge, and/or to recruit new employees with innovation-related knowledge [Anand et al., 2002; Cohen and Levinthal, 1990; Grant, 1996] to increase knowledge overlap among Web 2.0 users. Organizations also need to educate their customers on their existing products in order to trigger these customers' contribution of creative ideas [Nambisan, 2002] and to increase their employees' trust in these customers' competence to provide useful knowledge [Levin and Cross, 2004]. In addition, organizations should recognize and support the informal connections and the brokerage roles that emerge through Web 2.0 use [Cross and Prusak, 2002; McDermott, 1999]. Cross and Prusak [2002] underline the importance for managers to identify critical informal network-linking roles, such as boundary spanners and information brokers, and to openly and systematically work with them in order to make their brokerage activities more effective. Organizations can encourage and motivate the use of Web 2.0 applications through clear communication of the purpose and scope of Web 2.0 applications from top management [Desouza, 2003]; through external rewards [Davenport et al., 1998]; through the creation and promotion of knowledge-sharing and innovative [Ardichvili, Page, and Wentling, 2003; Martins and Terblanche, 2003], as well as customer-embracing [Bernoff and Li, 2008], organizational cultures; and through organizational vision building [Chiu et al., 2006; Nonaka et al., 2001]. In general, the more tactics managers employ to encourage Web 2.0 use, the more likely they will be satisfied with the result of the deployment of Web 2.0 applications [Bughin et al., 2008]. During the introduction of Web 2.0 applications, top management should take a supportive role and "let nature take its course" [Desouza, 2003, p. 87]; that is, they should let Web 2.0 users decide which knowledge to share and how to share it [McDermott, 1999], rather than try to direct and impose guidelines for Web 2.0 use [McAfee, 2006]. This principle is especially critical for building up dynamic capabilities with Web 2.0 applications in high-velocity markets [Eisenhardt and Martin, 2000]. When nature does take its course, social capital among Web 2.0 users will increase and knowledge-creation activities will emerge.

V. CONCLUSION

At the age of the knowledge economy, organizations need to know more than their competitors in order to survive. Nahapiet and Ghoshal [1998] argue that organizational knowledge creation is facilitated by the existence of the structural, relational, and cognitive dimensions of social capital among employees. Nonaka [1994] pointed out that organizational learning results from the processes of continuous knowledge creation and conversion. This incessant knowledge-creation spiral is enabled and supported by the emergence and sustenance of *Bas* among individuals

[Nonaka and Konno, 1998; Nonaka et al., 2001]. Linking social capital theory, the SECI knowledge creation model, and the concept of *Ba*, our framework is proposed here with the objective to uncover the mechanisms governing the phenomenon of Web 2.0-driven organizational learning and to provide a conceptual framing for future work. We hope what we present here will inform future practice and research concerning if and how organizations can strategically unleash the potential of Web 2.0 applications to facilitate organizational learning.

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Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the article on the Web, can gain direct access to these linked references. Readers are warned, however, that:

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