

# Enterprise 2.0: Collaboration and Knowledge Emergence as a Business Web Strategy Enabler

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## **ABSTRACT**

*The Web is becoming in many respects a powerful tool for supporting business strategy as companies are quickly becoming more and more reliant on new Web-based technologies to capitalize on new business opportunities. However, this introduces additional managerial problems and risks that have to be taken into consideration, if they are not to be left behind. In this chapter we explore the Web's present and future potential in relation to information sharing, knowledge management, innovation management, and the automation of cross-organizational business transactions. The suggested approach will provide entrepreneurs, managers, and IT leaders with guidance on how to adopt the latest Web 2.0-based technologies in their everyday work with a view to setting up a business Web strategy. Specifically, Enterprise 2.0 is presented as a key enabler for businesses to expand their ecosystems and partnerships. Enterprise 2.0 also acts as a catalyst for improving innovation processes and knowledge work.*

## INTRODUCTION

There is no doubt that the Web is in many respects a powerful tool for supporting business strategy. Emerging Internet technologies continue to enable businesses to expand their ecosystems and partnerships. This, however, introduces additional managerial problems and risks that have to be taken into consideration to avoid being left behind.

This chapter explores the Internet's present and future potential in relation to information sharing, knowledge management, innovation management, and the automation of cross-organizational business transactions. It points out how a business Web strategy that takes into account this potential will help not only to improve the existing information sharing and knowledge management processes, but also to protect investments in technology that would otherwise have resulted in expensive failures and severe losses. The suggested approach is based on the emerging Web 2.0 vision and will help to minimize the risk of key information and knowledge being lost or simply not being available on time for the stakeholder, projects started and never finished, worse time-to-market, results not meeting expectations, failure of global, cross-organizational IT integration processes, or even incoherencies between technology and company strategy or structure and so on (Argyris, 1998, pp. 98-105). All managers, and particularly IT leaders, must be aware of this new potential and its implications in order to come up with innovative and effective answers to both known and new problems related to information sharing and knowledge management within their organizations (McAfee, 2006).

The chapter's contents are designed to guide entrepreneurs, managers, and IT leaders through the adoption of the latest Internet technologies, such as Web 2.0, Enterprise 2.0, and the global service oriented architecture

(SOA), and their application to their everyday work with a view to setting up a business Web strategy. Musser and O'Reilly (2006) claim that by defining and following a set of architecture building blocks, architectural design decisions, and normative guidance, they can build flexible, extensible, and reusable solutions for exploiting the best features of the emerging Web 2.0 technology suite to achieve the best return on investment (ROI) by leveraging the upcoming Web of user-centered services.

## BACKGROUND: THE ADVENT OF ENTERPRISE (WEB) 2.0

There are several different definitions of Web 2.0 (a.k.a. *social networking*) that mostly only describe certain aspects of the overall concept. Tim O'Reilly (2007), who originally coined the term, initially identified seven major characteristics inherent to the Web 2.0 concept. First, the Web is considered as a platform for building systems that do not necessarily have a specific owner and are "tied together by a set of protocols, open standards and agreements for cooperation." Harnessing Web users' collective intelligence represents the second major paradigm. This promotes architecture by participation and democracy and encourages users to add value to the application as they use it. The ownership of mission-critical data is regarded a further cornerstone of numerous Web 2.0 applications. Fourth, O'Reilly propagates the end of the software release cycle as another central paradigm. The use of lightweight programming models that allow for loosely coupled systems and applications, the provision of software above the level of a single device, and the realization of rich user experience represent the last major paradigms inherent to the Web 2.0 concept. Besides such analyses that properly describe parts of the super-ordinate concept, there are only very few comprehensive scientific definitions available. An

in-depth investigation of numerous different, successful Web 2.0 applications conducted by Högg, Meckel, Stanoevska-Slabeva, and Martignoni (2006) condensed the respective characteristics into the following statement, which serves as underlying definition for this chapter: "Web 2.0 is defined as the philosophy of mutually maximizing collective intelligence and added value for each participant by formalized and dynamic information sharing and creation" (pp. 23-37).

The Enterprise (Web) 2.0 concept (henceforth referred to as *Enterprise 2.0*) is related to its big brother Web 2.0, because, to a certain extent, it can be viewed as many existing Web 2.0 consumer-oriented services maturing to include features that are important for enterprise users. Enterprise 2.0 represents on its own a new paradigm in which employees, regarded as *knowledge workers*, are coproducers of content, knowledge, applications, and services. Therefore, there is an imperious need to revisit and reconsider the very definition of knowledge worker during this chapter, because it is used extensively throughout the chapter from Davenport's (2005) viewpoint, that is, to refer to employees, partners, suppliers, customers and other possible stakeholders. Enterprise 2.0 provides enterprises with new models and tools for emergent collaboration and cocreation. Enterprise collaboration is thus being enhanced by virtual communities that leverage social linking and tagging tools (e.g., tools for social networking, social bookmarking, and social search), user-contributed content management platforms (e.g., enterprise wikis, blogs, and forums), tools that leverage user opinions (e.g., tools supporting comments and voting), subscription-based information distribution tools (e.g., Enterprise really simple syndication [RSS] feeds), user-centered services (e.g., mash-up- and pipe-based services), and so forth (Drive et al., 2004).

These digital platforms are already popular on the Internet, where they are collectively labeled Web 2.0 technologies (Laso, 2006). Now though, a number of Enterprise 2.0-based collaboration platforms are beginning to proliferate. These platforms are aimed at providing enterprises with specialized subsets of these out-of-the-box capabilities (Coveyduc, Huang, Ostdiek, & Reif, 2006; Intel Corporation, 2006). These new collaboration platforms provide enterprises with an ecosystem of knowledge workers who collaborate to develop capabilities by collectively generating, sharing, and refining information, business knowledge, and services. Enterprise 2.0 collaboration enables firms to leverage desirable Web 2.0 attributes, including harnessing collective intelligence and architecture by participation.

The user's production is now primarily based on the customization, composition, remix, and reuse of existing material, such as sampling or mash-ups, by the employees themselves. Enterprise 2.0 technologies have the potential to usher in a new era by making both information sharing, service provision, and consumption, and knowledge work practices and their outputs more visible. At the same time, they provide support for the extraction and the emergence of both knowledge and organizational structure.

In representation of the Gartner Group analyst firm, Smith (2006) recently predicted that by 2008 the majority of Global 1,000 companies will adopt several technology-related aspects of Web 2.0 to advance their businesses. As companies quickly increase their reliance on new Web-based technologies to capitalize on new business opportunities, the industry is showing greater demand for technology experts who can build and manage Web 2.0 resources, including blogs, wikis, forums and user groups, and mash-up enabler

tools to centralize the management of all of these resources, supporting technology and knowledge experts' work.

## **RESEARCH FRAMEWORK AND OBJECTIVES: FOSTERING INNOVATION THROUGH AN ENTERPRISE 2.0- BASED BUSINESS STRATEGY**

As global market opportunities, competition, and availability of human resources increase, enterprises are assigning high strategic priority to speeding up innovation, even by modifying their own business and global presence strategies. Enterprises want to speed up innovation to improve their market and business opportunities in the fierce global competition by collaborating and cocreating with partners and users (Coveyduc et al., 2006). The desired outcome is improved time-to-market and increased value of more new products and services. The emergence of Enterprise 2.0 Web-based platforms provides enterprises with new models and tools for collaboration and cocreation.

Enterprise collaboration can be fostered by virtual communities that leverage user content sites (e.g., Wikipedia, Flickr), social linking, tagging, and searching tools (e.g., MySpace, del.icio.us), and sites that leverage opinions of all who participate (e.g., Amazon ratings). Enterprises already leveraging cocreation are eBay API and Salesforce.com AppExchange. These platforms, as Weill and Ross (2004) note, provide enterprises with an ecosystem of partners, suppliers, and customers collaborating to develop capabilities by integrating knowledge and services. Enterprises want a solution that delivers these capabilities out of the box.

The key idea behind Enterprise 2.0 vision, and the lesson many businesses must learn, is that next generation IT systems must be

conceived to acquire the knowledge they operate on directly from who really has it, that is, the employees (seen as knowledge workers) and from the operation and communication processes employees enter into (Morris, Pohlmann, & Oliver, 2005). The knowledge of a business has less to do with the IT infrastructure than with the employees themselves. The IT infrastructure must be capable of extracting and managing that knowledge for it to evolve and adapt to the business processes. Any other means to model and exploit the business knowledge will never be flexible enough. If user knowledge changes (and it does change), the IT infrastructure must seamlessly adapt to such changes.

In any case, the design of both traditional and Enterprise 2.0-based solutions has focused primarily on creating a structure that supports common processes and stores information to assure that it is easy to find, reliably available, and backed up. They all have been conceived under the premise that teams need to focus on their core business rather than IT issues. The entire operating environment has therefore been traditionally subordinated to IT departments. Nevertheless, this approach has proved to have a number of collaboration-related drawbacks that slow down the pace of innovation. Knowledge workers are thoroughly acquainted with routine procedures and are capable of extracting automatic behavior, suggesting improvements on the IT systems they use through their operating environment and, more importantly, innovating new operating procedures. Operational innovation is an essential requirement in today's competitiveness-driven business markets, enhancing as far as possible collective intelligence-based knowledge work.

With this in mind, this chapter's main objective is to elaborate on the synergies the Web 2.0 concept and several IT technologies have with regard to the enterprise innovation.

Web 2.0's focus on the inclusion of human beings and the exploitation of users' collective intelligence is considered a key enrichment of the knowledge emergency within enterprises. This research objective will be contrasted with relevant literature reviews. The remainder of the chapter is structured as follows. First of all we revisit the notion of knowledge worker and its duty, analyzing its features, needs, and problems they find in their daily innovation effort. In this section we elaborate on factors that can facilitate or instead inhibit a knowledge work process. We then present solutions for fostering enterprise innovation based on Enterprise Web 2.0 ideas and technologies, a pragmatic guideline recommending the alignment of the business strategy exploiting Enterprise 2.0 advantages and the application of this idea to other key Web strategy areas. Finally, the final section concludes this chapter and presents a brief outlook on future trends.

## **ISSUES, CONTROVERSIES AND PROBLEMS IN ENTERPRISE COLLABORATION AND KNOWLEDGE EMERGENCY**

### **Knowledge Work Revisited: Novel Ways to Foster Innovation through Social Capital and Collective Intelligence**

Collective intelligence has existed for at least as long as humans have. Ancient social groups, nations, and modern corporations all act collectively with varying degrees of intelligence. But this ancient phenomenon called innovation emergence is now occurring in dramatically new forms. With new communication technologies, and especially the Internet, huge numbers of people all over the planet can work together in previously unsuspected ways. For this reason, it

is more important now than ever before to have an in-depth understanding of collective intelligence to be able to create and take advantage of the new possibilities. Our current definition of collective intelligence is "*groups of individuals doing things collectively that seem intelligent*" (Davenport, 2005).

In general, "collective intelligence" is a *perspective* that can be applied to many different kinds of phenomena. For instance, this perspective suggests another way of thinking about things like "firm productivity," "organizational effectiveness," "teamwork," "firm profitability," and "leadership." When people hear the term "collective intelligence," they tend to assume that it implies individuals giving up their individuality to be somehow subsumed in a group or team. This is *not* what we mean. Collective intelligence, as we understand and explore it, is not about false consensus, hive minds, cults, or group-think. Collective intelligence relies upon and emerges from a synergy between the individual knowledge, creativity, and identity of its constituent parts (Brown & Duguid, 2000). In its highest forms, participating in collective intelligence processes can actually help people self-actualize while solving collective problems. This collective intelligence is developed within enterprises by the innovative engines called knowledge workers.

As we mentioned above, nowadays enterprises need to accelerate innovation to improve their market and business opportunities in global competition, and therefore it becomes essential to revisit features, profiles, and characteristics of key actors in every innovation process, hence, the knowledge workers. This will help in understanding of the relevance of Enterprise 2.0 technologies and models for both improving their work and expanding their productivity, as we will tackle in subsequent sections.

## Knowledge Workers. Mission, Relevance and Novel Ways to Improve their Work

There is a range of ideas about what *knowledge workers* are and what characterizes them. Some examples are:

- “The term *knowledge worker* was coined by Peter Drucker some thirty years ago to describe someone who adds value by processing existing information to create new information which could be used to define and solve problems. Examples of knowledge workers include lawyers, doctors, diplomats, law makers, marketers, software developers, managers and bankers.” (Fallows, 2005)
- “Knowledge workers use their intellect to convert their ideas into products, services, or processes” (Davenport, 2005).
- “Their main value to an organization is their ability to gather and analyze information and make decisions that will benefit the company. They are able to work collaboratively with and learn from each other; they are willing to take risks, expecting to learn from their mistakes rather than be criticized for them.” (Davenport & Prusak, 1997)
- “Knowledge workers are continually learning, aware that knowledge has a limited shelf life” (Davenport & Prusak, 2000).

What then is a knowledge worker?

- A problem solver vs. a production worker
- A person who uses intellectual rather than manual skills to earn a living
- An individual who requires a high level of autonomy
- A manipulator of symbols; someone paid for quality of judgment rather than speed of work
- A worker who uses unique processes

- Someone who possesses uncoded knowledge which is difficult to duplicate
- A worker who sources between the ears
- Someone who uses knowledge and information to add to deeper knowledge and information

Fewer and fewer people are subordinates, even in fairly low-level jobs; increasingly they are knowledge workers. Knowledge workers cannot be managed as subordinates; they are associates. The very definition of a knowledge worker is one who knows more about his or her job than anyone else in the organization (Davenport & Harris, 2007).

According to Nonaka and Takeuchi (1995), what motivates workers—especially knowledge workers—is what motivates volunteers. Volunteers have to get more satisfaction from their work than paid employees precisely because they do not get a paycheck. They need, above all, challenge. They need to know the organization’s mission and to believe in it. They need continuous training. They need to see results. Implicit in this is that employees have to be managed as associates and/or partners, and not in name only. The definition of a partnership is that all partners are equal.

Davenport (2005) elaborates on this idea when stated that the productivity of the knowledge worker is still abysmally low. It has probably not improved in the past 100 or even 200 years for the simple reason that nobody has worked at improving the productivity. All our work on productivity has been on the productivity of the manual worker. The way one maximizes their performance is by capitalizing on their strengths and their knowledge rather than trying to force them into molds.

## Types of Knowledge Workers

From the practical perspective outlined in this chapter, it can be very useful to consider three separate types of knowledge worker: “core knowledge workers,” “*high-end* knowledge workers,” and “everyone else.”

- Core knowledge workers are those in specific “knowledge management” roles and enterprise duties. Examples of these kinds of roles include chief information/knowledge officers, librarians, knowledge managers, content managers, knowledge analysts, information officers, and so forth.
- “High-end” knowledge workers, or those with the highest degree of education and expertise, would seem to be particularly important to enterprise innovation. They are the scientists who develop the new products, the professionals who plan and sell the big consulting or legal projects, or the hardware or software architects who envision and deliver the new product line. In the knowledge economy, these should be the horses that pull the plow (the people to whom we should look for the new ideas, products, and services that fuel revenue growth and ensure organizational longevity) (Davenport & Harris, 2007).
- Everyone else is all the other knowledge workers (e.g., dentists, doctors, nurses, managers, pharmacists, technicians, administrators, etc.). In short, everyone in the organization engaged in some form of “knowledge work.”

Of course, there is not always a clear dividing line between these classes, but the distinction can be a helpful one at the start. It can be particularly useful for helping people to understand that everyone in a company is a knowledge worker to some degree, and knowledge work is everyone’s

responsibility, not just that of a few people with “knowledge” or “information” in their job title.

## Features of HEKWs (High-End Knowledge Workers)

1. They control their own work structure; high-end knowledge work remains relatively unstructured and autonomous. No one generally tells these workers where to work, when to work, or what specific tasks to perform during work.
2. They are highly collaborative.
3. They work in multiple settings.
4. They do individual and group work.
5. They have high levels of passion, power and occupational mobility.

## Knowledge Types Managed by Knowledge Worker

Here is one classification for different types of knowledge.

- Logical: There is knowledge that is the result of the understanding of how ideas relate to one another in a domain.
- Semantic: There is knowledge that is the result of learning the meaning of words or concepts. Knowledge of words is knowledge of definitions. Such definitions are set out in dictionaries. You can look this knowledge up.
- Systemic: There is knowledge of mathematics and geometry, for example, which is the result of learning a system of words, or symbols, and how they relate to one another and the rules for operating in that system. Any claims made that are consistent with those definitions and rules are called knowledge.
- Empirical: There is knowledge that comes through our senses. This is empirical

knowledge. Science is the best example of a method for ascertaining the accuracy of such knowledge. Scientific knowledge is a result of practicing the scientific method, that is, observation, abduction of a hypothesis, careful observation, refinement of the hypothesis, deduction of a test for the hypothesis, testing and experimentation, and confirmation or falsification of the hypothesis.

In addition, knowledge can be viewed from another point of view as implicit and explicit knowledge.

### **Informative Channels used by Knowledge Workers**

Traditional knowledge management programs attempt to manage the process of creation or identification, accumulation, and application of knowledge or **intellectual capital** across an organization.

By exploiting several informative channels, the guidelines of core knowledge workers can be made accessible for everyone else in the company. This approach looks to emerge and apply collaborative and social knowledge to create a **social capital** across the organization (Lin, Burt, & Cook, 2001).

The following is a list of informative channels used by core knowledge workers in Enterprise 2.0:

- e-mails
- chats
- blogs
- RSS feeds
- portal or Web content
- links and reverse references (links in blogs)
- wiki tools

- folksonomies
- bookmarks (tagged or not)
- documents of every kind, including files in ftp, printed papers, and so forth
- physical communication in person
- physical communication in distance (e.g., phone)
- common applications as enterprise mash-ups

## **Factors in Knowledge Work**

### **Facilitating Factors**

Bloom (2000, pp. 42-44) identifies the following five elements as causing a group to be intelligent (a “collective learning machine”):

1. *Conformity enforcers*: Mechanisms that cause consensus and similarities among most members of the group.
2. *Variety generators*: Mechanisms that cause some differences and discussion among members of the group.
3. *Inner judges*: Mechanisms that cause individual members of a group to reward themselves for successes and to punish themselves for failures, and cause everyone to evaluate a concept or idea, and validate it after their own experience-based verification.
4. *Resource shifters*: Mechanisms that shift resources (e.g., admiration, information, data, concepts, knowledge, money, or influence) to members of the group.
5. *Intergroup tournaments*: Competitions between subgroups or departments (such as games, corporate competitions, rivalry discussions, etc.)

Other authors, like Surowiecki (2005), say that there are three conditions for a group to be intelligent (for a “crowd to be wise”):



1. *Diversity*: The group includes members with a wide diversity of knowledge or abilities (and the ability to recognize successful and unsuccessful outcomes).
2. *Independence*: Group members use their own knowledge and abilities without being overly influenced by others. (When group members have too much influence over each other, various kinds of bad outcomes can result. See inhibitory factors section below.)
3. *A particular kind of decentralization*: Group members' actions are aggregated in a way that finds the right balance between: (a) "making individual knowledge globally and collectively useful," and (b) "still allowing it to remain resolutely specific and local."

### Inhibitory Factors

Finally, there are several general factors that can inhibit collective intelligence, such as groupthink and informational cascades, social dilemmas, coordination failures, or failures in thinking itself (Malone, Jay, Legay, & Kosorukoff, 2006).

The first barrier to collective intelligence is called groupthink and social conformity, which was described by Janis (it is perhaps the best explored factor) and developed further in numerous experimental studies. The key point of this research is that people's tendencies to conform, imitate, and avoid conflict can reduce the effective diversity of opinions, and lead to judgments and decisions that are inaccurate, premature, systematically biased, and so forth. The analogue to this phenomenon in pragmatic distributed collective intelligence, as James Surowiecki points out in *The Wisdom of Crowds*, is the informational cascade, where imitation produces fads and conformity instead of individual decision making. In other words, the knowledge of the whole turns out to be less than the sum of

the parts, because *only some parts are actually contributing while everyone else conforms or imitates*. For this reason, mechanisms that foster diversity and independence might improve collective intelligence. At the interpersonal level, this means practices and norms surrounding respect for individual ideas and contributions (as in the early stages of a brainstorming session). At a distributed level, this results in structural barriers in the physical, legal, or IT "code" (e.g., the walls around a voting booth).

An excellent example based on heuristic experiments of how early decisions by some group members can unduly bias the decisions of later group members is the study of online music ratings by Salganik, Dodds, and Watts. Here is a summary of that study from its online abstract:

Hit songs, books, and movies are many times more successful than average, suggesting that 'the best' alternatives are qualitatively different from 'the rest'; yet experts routinely fail to predict which products will succeed. We investigated this paradox experimentally, by creating an artificial 'music market' in which 14,341 participants downloaded previously unknown songs either with or without knowledge of previous participants' choices. Increasing the strength of social influence increased both inequality and unpredictability of success. Success was also only partly determined by quality: the best songs rarely did poorly, and the worst rarely did well, but any other result was possible. (Salganik, Dodds, & Duncan, 2006)

A second category of barriers includes prisoners' dilemmas, social loafing, and tragedies of the commons (Davenport & Prusak, 2000). These dilemmas or barriers, which involve disincentives for collective performance, are less explored, and described in less depth in economics. They apply at both the interpersonal level (e.g., social loafing in teams) and at the distributed level (low voter participation in democracies). The knowledge and intelligence of the whole turns out to be less than the sum of the parts because *some parts*

*contribute but others slack off.* This tells us that it would be important to consider carefully structured incentives to reward individual participation as well as collective intelligence. This naturally occurs in futures markets and betting, but further application and innovation on such ideas is possible.

While the first two barriers involve mechanisms that suppress or delete individual contribution, a third category involves failures to integrate contributions when they are made adequately. Surowiecki offers the traffic jam as a simple example. Information overload on the Internet is another. The knowledge and intelligence of the whole turns out to be less than the sum of the parts because *the parts' contributions interfere with or cancel each other*. Solving this problem chiefly involves evolving structures and practices that coordinate individual and group contribution. At a distributed level, structures are highly visible, albeit incompletely studied. For example, there are congestion pricing for traffic systems, eBay's auction and interpersonal rating system, Amazon.com's collaborative filtering, Google's algorithm for search ranking, Wikipedia's review practices (as studied by Giles [2005, pp. 900-901]), and so forth. There is similar wealth on the interpersonal side, although many of the practices remain proprietary or tacitly in the hands of professional facilitators.

A final category of barriers to collective intelligence and innovation emerges from William Isaacs' work on dialogue. His theories build upon work by physicist David Bohm on "thought as a system," a new perspective in which all thinking and intelligence is understood to be collective. Within the system of collective thinking, Isaacs identifies four key pathologies that decrease collective intelligence. For each of pathology, he describes a principle that should be kept in mind and a dialogue practice for individuals to refine

their own awareness and intelligence quality and contribute to fostering collective intelligence (Malone et al., 2006):

- **Abstraction/Fragmentation:** The tendency to hold oneself distant or separate from the world, for example, by abstracting or compartmentalizing it.
  - Siloing is a clear symptom of this kind of phenomenon: "That's an economics problem, not a psychology problem"; "That's a marketing problem, not a manufacturing problem"; "Not invented here."
  - Staying high on the so-called "ladder of inference" (Argyris, 1998), that is, arguing at the level of fragmented and reified ideas instead of about the flow of experience and data.
  - An example of this issue is: "This is a unique case" instead of "this is a symptom of how the whole thing is working."
  - Antidote: Listening (to data, to people, to the innovation emergence); that is, the principle of *holographic participation*, which is all things are whole, connected.
- **Idolatry of Memory:** The repetition of automatic answers, routines, stereotypes, and behavior patterns from memory.
  - "We solved that problem years ago"; "That's just the way we've always done things around here"; "We have a human resources department, therefore we're taking care of our people."
  - Antidote: Voicing what is actually new and emergent in one's understanding and experience; that is,

- the principle of unfolding *potential*, which is, the universe is always unfolding and producing the new.
- Certainty: The “knowledge” that one’s view (often a manager or chief officer) is correct.
  - “That’s impossible”; “There’s no way that could be true.”
  - Antidote: *Suspending* one’s assumptions and prejudices for personal and collective reflection, that is, the principle of *proprioceptive awareness*, which is learning to see and feel how your assumptions are affecting your thinking and actions.
- Violence: The repression, disrespect, and destruction of alternative points of view in order to force acceptance or consensus of one’s own understanding.
  - “No educated person could take that view”; “You’re an idiot for believing that”; “That’s all well and good, but...”
  - Antidote: Respecting diversity of opinion, style, and knowledge; that is, the principle of *differentiation*, which is, diversity is natural and valuable, and collective intelligence means fostering differentiation and integration.

Enterprise 2.0 ground rules are related to these strong and weak factors of collaborative intelligence (Davenport & Prusak, 1997) and tackle each one of them to adequately emerge social capital.

## **SOLUTIONS AND RECOMMENDATIONS TO FOSTER COLLABORATION AND KNOWLEDGE EMERGENCY THROUGH ENTERPRISE 2.0 IDEAS**

### **Enterprise 2.0 Key Technologies and Models for Improving Knowledge Work**

As mentioned above, Web 2.0 and its application in enterprises can be seen as the computer industry’s business revolution caused by the move to the Internet as a platform, and an attempt to understand the rules for success on that new platform. The key rule is to build applications that harness network effects to improve as they are used by more and more people.

The concept of Web-as-participation-platform captures many of these characteristics from the viewpoint of the new software as a service (SaaS) paradigm. Bart Decrem, founder and former CEO of Flock, calls Web 2.0 the “participatory Web” and regards Web-as-information-source as Web 1.0 (O’Reilly, 2004).

The following sections deal with the different existing Enterprise 2.0 technologies from two different viewpoints: first, a service-oriented perspective that is paving the way for a user-centered Web of services, recently termed as global SOA (Schroth & Christ, 2007); and second, a user-centered content driven perspective, comprising enterprise blogs, wikis, RSS, and other business knowledge channels.

## Service-Oriented Enterprise 2.0 Technologies

The number of enterprises that are bringing their business systems to the Web to automate cross-organizational business transactions is constantly growing. Porter (2001) says that benefits of performing such transactions electronically include extending market reach, saving time, cutting costs, and responding to customer queries more agilely. Renowned scientists such as Malone (2001) cite the relentless march of improvements in the cost-performance ratio of information technology as the main driver of this development. SOAs have attracted, as McAfee (2005) notes, a lot of interest during the last few years as they are expected to play a key role as enablers of seamless application-to-application integration, both within company boundaries and on a global, cross-organizational scale, required to build this scenario.

From a technological viewpoint, Web services (Alonso, Casati, Kuno & Machiraju, 2004) have been massively adopted as the technical foundation for the realization of SOAs. Even so, Web Services-based SOAs mostly only exist within company boundaries at present (Roman et al., 2005, pp. 77-106). The global provision and consumption of services over the Internet is still at an early stage and has not yet taken on a significant role in realizing cross-organizational collaboration in an *Internet of services*.

Several reasons, such as high technical complexity, implementation and maintenance costs, inflexibility, and the lack of widely accepted standards for defining service choreographies as well as message semantics, have been repeatedly identified as key factors that have prevented the emergence of a global mesh of interoperable Web services, as Hinchcliffe says (2007). Further hurdles on the path to a "global SOA" include the lack of global-scale service discovery, as well as

platforms allowing for intuitive human-guided service interaction and composition. Recently, the emergence of the Web 2.0 phenomenon is expected to act as a facilitator of such a global SOA (McAfee, 2007). Novel Web 2.0 technologies and design principles are now about to experience increasing acceptance as they allow for reusing, customizing, interconnecting, composing, and finally exposing Web-based content or functionality again as new resources. They are, therefore, considered not as a substitute for, but as an enrichment of, SOA concepts and technologies (Schroth & Christ, 2007; Schroth & Janner, 2007).

## User-Centered Global Service Oriented Architectures (Global SOA)

A number of Enterprise 2.0 collaboration platforms are beginning to proliferate. By leveraging desirable Web 2.0 attributes, these platforms provide enterprises with an ecosystem of employees, partners, suppliers, and customers who collaborate to develop capabilities by collectively generating, sharing, and refining business knowledge. Nevertheless, enterprise collaboration should evolve towards a new paradigm in which knowledge workers are considered as coproducers not only of information, but also of software services and applications that promote specific competitive advantages and/or meet their immediate needs, without involving IT departments. The Web 2.0-based approach to a global SOA empowers users to coproduce and share instant applications and thus represents a major step forward to evolving the above ecosystem into one in which all the stakeholders will also be able to collaboratively develop capabilities and innovate operating procedures by remixing and integrating already available services through the emerging ideas of Enterprise 2.0 mash-ups ("Mashing the Web," 2005).

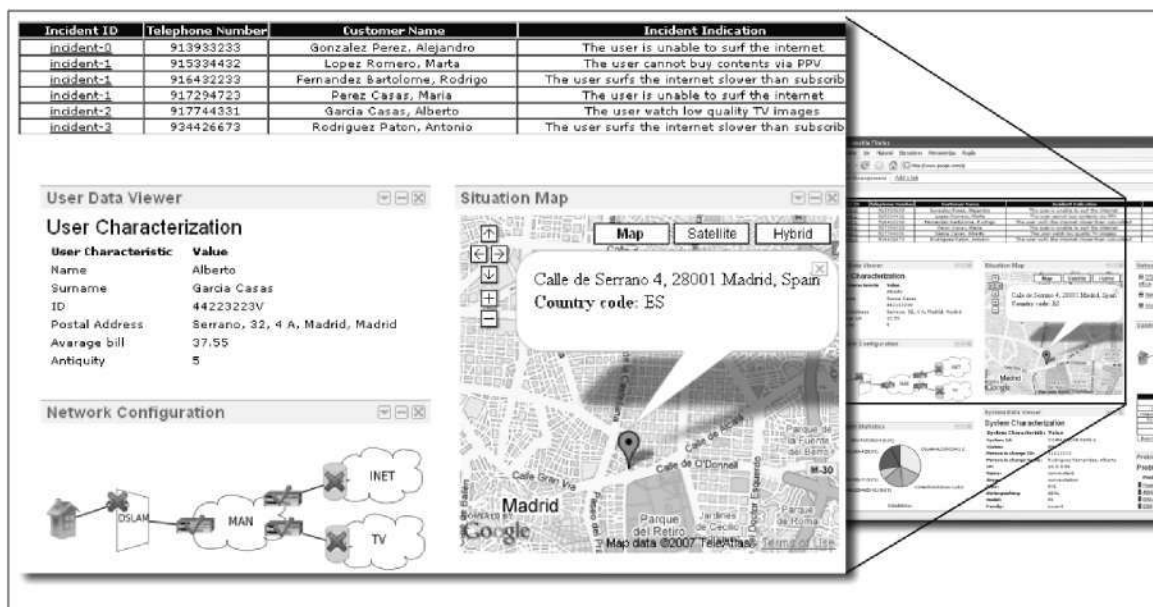
## Enterprise 2.0 Mash-ups

Content-driven mash-up-oriented programming (a.k.a. situational programming or instant programming) (Smith, 2006) is a new agile application development paradigm<sup>1</sup> in which knowledge workers, who do not have previous coding skills but do have extensive domain expertise, visually assemble and combine off-the-shelf gadgets (a.k.a. widgets), that is, discrete self-contained domain data-oriented components, with both development (service and data binding and interconnection) and runtime rendering capabilities. These gadgets represent the basic building blocks for knowledge workers to assemble new services (e.g., SOAP or REST-based lightweight Web services), data sources (e.g., Atom/RSS feeds) and other gadgets, and to render them as necessary to develop the application they need in a very short time. The kind of hybrid application that results from applying this new paradigm is often called enterprise

mash-up (a.k.a. situational application or instant application) (Hof, 2005).

A simple example would be a mash-up connecting three gadgets: a list of tasks involving customers, an agenda of customers, and a Google map. By attaching the three to each other, the agenda gadget will display the customer's details and the Google map gadget will display the customer's address on a map as you scroll the task list. This would be useful, for example, for an employee responsible for the task of geographically locating the customer. It is the knowledge worker who can develop this "service," and do it on the fly with the help of mash-up enablers. This way a business person could build a "dashboard" to see how weather is affecting sales at retail outlets. By aggregating information from public Web sites, such as mapping and weather services, the business person could assemble a very useful, albeit simple, content-

Figure 1. Creation of an EzWeb platform-based enterprise mash-up



driven application. Companies are trying to capitalize on these technologies (Smith, 2006) with software and services for relatively short-lived, quick-to-build applications.

Figure 1 depicts a real scenario extracted from a Telefónica-based mash-up which connects four gadgets: a list of tasks involving customer requests, a customer agenda, a Google map, and a network status map. Figure 1 shows how Telefónica's operational support systems' (OSS) knowledge workers create a fully functional environment on their own by visually attaching these gadgets to each other and to the enterprise backend; the agenda gadget will display customer details and have a customer/task selection option, the network map will represent the selected customer's network status, and the Google map gadget will display the selected customer's address on a map when a given task is selected from the list. This enterprise mash-up environment is useful for a user responsible for the task of testing the status of all systems used by a customer. In the event of a problem in the customer's local telecommunications infrastructure, customer geographical location is a big help for the technician to prepare the visit to the customer's home.

As mentioned above, traditional Web services are provided as functionality described by arbitrary (mostly WSDL compliant) interfaces that define input and output messages, as well as the supported service functions. These interfaces are not human-readable and do not facilitate the interaction of users with the underlying services. In the mash-up context resources no longer target technical experts in the corporate context but now go for the huge number of individuals (Anderson, 2006), of Internet users who require intuitive visual means for retrieving resources on the Web and for capturing their respective functionality.

This way, the Web 2.0-based approach to a global SOA delivers a mash-up-enabled infrastructure to help businesses share and collabo-

rate with the business ecosystem and partners instantly. In doing so, enterprise collaboration architectures introduce the mash-up-oriented lightweight programming model as a means for knowledge workers to collaborate in solving an immediate, specific business problem by blending externalities with private business content and services.

The way services are discovered, used, and managed by knowledge workers is fundamental in terms of both the ICT technology and the cultural aspects involved in implementing this enterprise collaboration paradigm shift (Salganik et al. 2006, pp. 854-856). In this respect, user-service interaction must embrace a number of principles to ensure the widest acceptance by knowledge workers. The most important that have been identified are:

1. *Knowledge workers must feel fully empowered and able to serve themselves from available resources that provide them with access to the content and services they can use to set up their own personalized operating environment in a highly flexible and dynamic way.*
2. *Active user participation must be enabled. Knowledge workers must be able to contribute new and improved versions of resources, as well as share further knowledge about these resources, their use, and their inter-relationships.*
3. *Community-based collaborations need to be fostered. The introduction of a share, reuse, and assembly culture of collaboration will boost and speed up this process thanks to the network effect.*

To exploit this approach to the maximum, IT departments will need to embrace the SaaS model as an effective software-delivery mechanism. This will change the department's focus from deploying and supporting applications to managing the services that those applications

provide. Knowledge workers will now extend and improve these services in a collaborative fashion to exploit their extensive domain expertise and their thorough business knowledge.

### **Enterprise Mash-ups as a Means to Drastically Improve Time-to-Market**

Internet technologies continue enabling businesses to expand their ecosystems and partnerships. This expansion process means, on the one hand, that the information technology effort focuses on work items related to integration, usually requiring a minimum of 6 months per request. On the other hand, partnerships change, and some business collaborations last less than 12 months. Consequently, there is a whole bunch of applications not being written today because they are not affordable due to time-to-market constraints and/or because there is no justification for IT investment. Knowledge workers' needs are typically of short duration (ranging from one week to several months), thereby limiting justification for IT investment too. It would be sufficient if they were provided with informal, just-in-time access to domain content, and were able to create their own short-lived ad hoc application for each individual need, without the need for IT investment.

Enterprise 2.0 mash-ups, and the associated application development paradigm, clearly fulfill these needs. Mash-ups will help businesses share and collaborate with the business ecosystem and partners instantly. This in turn will help evolving enterprise collaboration towards a new paradigm in which knowledge workers (without previous programming skills, but with thorough business knowledge) are considered as coproducers not only of information, but also of software services and applications that promote specific competitive advantages and/or meet their immediate needs, without involving IT departments, and share the solution with the remainder of the organization.

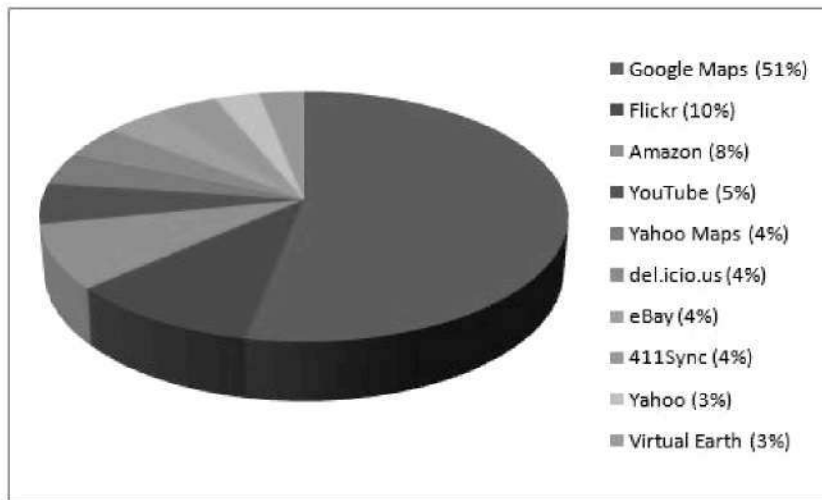
This will lead at last to an ecosystem of knowledge workers collaborating to develop capabilities and innovate operating procedures by remixing and integrating available services, exploiting the collaborative intelligence. Community-based collaborations could speed up this process thanks to the network effect caused by broader community support and participation (architecture by participation). Additionally, the introduction of a reuse and assembly culture will boost this process, allowing strong business value synergy and linkages.

### **Current Impact of Enterprise 2.0 Mash-Up Technology**

The ProgrammableWeb.com Web site acts as a major aggregator of numerous (currently over 1,600) references of assorted mash-ups existing all over the world. It provides statistics about used resources, a classification of mash-ups by categories, as well as user statistics to evaluate mash-up popularity. Therefore, it serves as a central source of empirical data to work with. Several facts can be inferred from these data:

- First, large companies such as Google, Amazon, and Microsoft started to successfully provide Web-based resources that were leveraged by numerous users to create mash-ups. At least 836 Web-based applications have already integrated the "Google Maps," a resource that offers geographical data.
- Second, there is a shift away from the professional corporate context towards a private, end-user driven field of applications. As opposed to the focus of traditional Web services, the resources used for building mash-ups target the long tail of Internet users and deal with media management, shopping functionality, entertainment, or desktop applications. Heavy-weight enter-

Figure 2. Chart of most popular mash-up resource providers (according to ProgrammableWeb.com)



prise applications for automating business transactions can only rarely be found in this context.

- Third, besides the SOAP protocol, which is also used in the context of traditional Webservices, “light-weight” protocols, like REST (Fielding, 2000) and RSS, are widely leveraged to allow for fast and seamless mashing of different resources.

Summing up, the Web can increasingly be considered as a comprehensive and global development platform containing numerous easily usable and mashable resources that are provided by large firms, as well as by SME and even individual end-users. As argued above, the provision of resources that use lightweight protocols based on uniform interfaces, such as REST or RSS, and also the focus on end-user requirements rather than business-to-business relationships represent core success factors for this new global SOA consisting of numerous mash-ups. Figure 2 shows the current most popular providers of resources leveraged for the creation of mash-ups.

### User-Contributed Content-Driven Enterprise 2.0 Technologies

Of the existing categories of Enterprise 2.0 technologies now available, technologies for content management (enterprise *wiki/blogs*), contract management, project management, enterprise mash-up platforms, messaging and e-mail, signaling (feeds), listing services, social network analysis and analytics, social search, media, collaborative categorization (a.k.a. *folksonomy*), online Web storage, supporting infrastructure, organizing, social networking, consumer or work-group *wikis*, massive collaboration, and business process management are worth mentioning (Redding, 2006). There will be significant differences in companies’ abilities to exploit these technologies due to the challenges they bring with them. Because of the opportunities these technologies offer, these differences will matter a great deal. It is important to get an understanding of their real potential and drawbacks, as well as how to take advantage of them holistically.

Andrew McAfee (2006, pp. 21-28) first introduced the acronym SLATES to indicate



the six components of Enterprise 2.0 technologies: search, links, authoring, tags, extensions, and signals. As technologists build Enterprise 2.0 technologies that incorporate the SLATES components, they seem to be following two intelligent ground rules following McAfee's vision of SLATES. First, they are making sure their offerings are easy to use. Second, Enterprise 2.0 technologists are trying hard not to impose any preconceived notions on users about how work should proceed or how output should be categorized or structured. Instead, they are building tools that enable these aspects of knowledge work to emerge. In the following sections we elaborate on the key Enterprise 2.0 technologies that will help a business to successfully exploit every SLATES component.

### Enterprise Blogging

Bloggging allows users to keep track of ideas and their authors, including concept redefinitions or business process information on a time line in a Web page, as if it were traditional Web content information. This information evolves like an approximating definition cycle based on dialogue and creative discussion, looking around for near ideas and issues to express enterprise knowledge.

There are several social networking functions in enterprise blogging that show the difference between simple blogging systems and systems used for triggering network effects across an organization. Some interesting insights about internal blogging in the *Enterprise Blogging in Practice* case study follow (Rand, 2004).

Michael Cot notes, "At the department level, I wouldn't say that blogs have been a wide-reaching, raging success, primarily because people don't post to them as much as you'd hope. However, for the people who do post to and read the blogs, they've been very successful" (Rand, 2004).

Among many other things, people usually post information at their company about their own stories and experiences, the status of tests, brainstorming-based ideas or issues, customer visit/phone call notes, comments that are only useful to bring attention to or track an employer with a project, requests for ideas or help, and even off-topic posts that can be useful for enforcing social networking relationships.

But the biggest problem is limited search capabilities. Without a Google-like quality search (i.e., near real time and full indexing, page-rank, quick search results, etc.) of the enterprise Intranet, it is very hard to find anything, let alone blog posts on relevant topics. People have been shown to get smarter a lot faster using social networking software (a lot of organizations of all sizes are using this Enterprise 2.0 application to trigger network effects and for innovation fostering). In addition to the enterprise blogging platform, it is interesting to stimulate several social networking system functions in Enterprise blogs (Wacka, 2005):

- Contact list (create informal groups or social networks) to maintain easy contact with community members
- Private messages
- Attach files (.doc, .pdf, .zip) and add tags and notes to them
- Advanced taxonomy with both structured and unstructured (free tagging) support
- Powerful ajax editor
- Tasks (to-do lists) for easy collaboration and project management
- Threaded comments for robust discussions
- Revision control
- Basic polls (advanced polling, surveying, and quizzes are available)
- Profiles
- Advanced search

- News aggregator (read RSS feeds and XML files)
- Syndication (generate RSS feeds and XML docs for content, profiles, tags, categories, etc.)

This way, it would be easier to make content and profiles precise. With structured and unstructured categories, it is easier to find people or content on the “long tail” of a curve (Kline & Burstein, 2005). In addition, it is possible to use tracking of individual profiles and posts to monitor user activity (i.e., to find out what others in the community are reading and writing).

Enterprise blogging should offer a useful way for connecting, creating, and collaborating on project management, help desks, finding and identifying experts (people aggregator), recruiting experts, talent, or ideas or innovation management, open innovation and its visibility, knowledge management, product development, and other off-topic tasks.

This platform would provide a comprehensive online ecosystem, a tightly integrated set of publishing, communication, and networking features that support and enable an online experience like never before. Users could engage, create, and share their content online (publicly or privately) in a multitude of ways to achieve greater performance. This technology will help to discover the purpose (i.e., connecting, creating, and collaborating) of an enterprise community in order to improve the company’s business strategy. Knowing the purpose determines how the system is configured, how it flows, and how well it succeeds, and therefore the best strategy to carry out.

The following are some tips from Dion Hinchcliffe’s (2007) “Nine Ideas for IT Managers Considering Enterprise 2.0,” which are easily adaptable to enterprise blogging:

1. It is about ease-of-use, first and foremost.
2. Change requires motivation. Provide it.
3. Emergent does not mean a blank slate.

4. Discoverability is not an afterthought, it is the core.
5. It is okay to fear loss of control and misuse.
6. Dynamic, effective advocates are a key enabler.
7. The problems will be with the business culture, not the technology.
8. Triggering an Enterprise 2.0 ecosystem quickly is likely to be an early activity driver.
9. Allow the tools to access enterprise services

### **Enterprise Wiki: The 2.0 Approach of Content Management Systems (CMS)**

A wiki can be defined as a piece of server software that allows users to freely create and edit Web page content using any Web browser. Wiki supports hyperlinks and has a simple text syntax for creating new pages and crosslinks between internal pages. Because it allows “everyday users to create and edit any website page, it is exciting in that it encourages democratic use of the Web and promotes content composition by non-technical users.”

There are some fundamental Wiki design principles, but the most important principle that makes wiki different from any other Web site source is that it allows any enterprise readers to edit the page content as they see fit, if they feel the content is insufficient or poorly organized. If you come across any mistakes in the document as you read an information item, or you have more information that you would like to add to the item, just click on “Edit Text” and you, too, can change the content.

Because wiki is mainly designed to promote content composition by nontechnical users, the formatting rules for editing a wiki are fairly simple, and there are no complicated markup languages. Wiki content generally contains a lot of accurate information, because

inaccurate information will be very quickly corrected by other readers.

The main idea of not having anyone to control the content in a centralized way, and/or of allowing *anyone* to edit and publish a document real-time is inconceivable for most people.

Therefore, a wiki can be the underlying technological support for creating a common sharing, emergence, and conceptualization of mash-up data, playing a similar role to ontologies in the Semantic Web vision. In fact, wiki software has demonstrated that *it works well in a small community of like-minded people, like an enterprise community*. Documents build up very fast as many people contribute small, manageable pieces. Some contribute contents and information, some contribute links, some correct grammar, while others fix the structure and formatting. Therefore, enterprise wiki allows the input of common descriptions and definitions of key business concepts, that is, everyone in the company can find a resource, bring experience to bear to evaluate and improve the resource. Wiki contents and data follow an iterative lifecycle, and their description undergoes constant improvements, refinements, and evolution.

There are several applications defined as enterprise wiki enablers, like Confluence, Social Text, or Twiki (*InfoWorld* proclaimed 2004 to be the “Year of the Enterprise Wiki”). Heightened interest comes in response to the increasing number of organizations like Google, Nokia, and Yahoo! who are turning to wikis as a way to improve internal efficiency.

### Wikis and Content Management

Wikis fall conceptually under the broad concept of content management systems, and users could certainly use the existing CMS to create a *wiki-like* site. However, wikis have unique characteristics

that differentiate them from traditional CMS (Choate, 2006).

Wikis emphasize ease of content creation. This simplicity has many sources: a wiki markup language that provides a short-hand way of linking documents and formatting text; the ability of users to edit and create pages independently and directly; a bottom-up approach to site navigation and structure; a very simple templating framework; and, finally, a conscious decision to eschew workflow or even simple approval steps.

### Content Creation and Editing

Wiki software focuses on the empowerment of users to create and edit their own pages, but content management systems provide tools for creating and editing content, too. The difference is in their approach. When wikis first came out in 1995, there were not a lot of options for WYSIWYG editing from within a browser, so the wiki markup language (sometimes called “wikitext”) provided a particularly valuable short-hand for formatting text that was much easier to learn than pure HTML (Heigl, Glaser, & Anja, 2006).

A good CMS will offer a WYSIWYG interface that makes writing content for the Web, like using a word processor. More wikis nowadays have WYSIWYG editing features, so the wiki markup language is a less interesting feature in terms of formatting, although it does provide the benefit of being supported by all browsers on all platforms, something that is not usually the case with rich-text editors. Many wikis support both wikitext and rich-text editors.

However, there is one area where wikitext still retains its power: linking resources and knowledge. Wiki software still provides a much easier way to link pages within the wiki to each other. Links are made based on the title of a page, so the author does not need to use, remember, or type long URLs in order to link one page to another.

## Site Structure and Navigation

Contributors can create new knowledge, pages, contents, and can easily link one page and data to another (Venners, 2003); wikis offer a new unique approach to navigation and site structure.

Traditional information systems usually take a more formal approach to site structure and navigation through enterprise knowledge, with the site organized into a hierarchy by an information architect. User-created pages in a wiki mean that the hierarchy and structure of the site is created in an ad hoc way. Navigation tends to be simple, and the hierarchies are flat. For example, the Wikipedia online encyclopedia has hundreds of thousands of articles on a broad range of topics, but these topics are not arranged in any conceptual hierarchy. The entry for dogs serves as a good illustration. The URL for the article about dogs is: <http://en.wikipedia.org/wiki/Dog>

A pug is a kind of dog, and the URL for the pug entry is: <http://en.wikipedia.org/wiki/Pug>

Since a pug is a kind of dog, you might expect to see the following URL for pugs: <http://en.wikipedia.org/wiki/Dog/Pug>

But it is not there. Several wiki software solutions support more complex content categorization, but many are totally flat, like Wikipedia. Even if the software supports subconcepts, contributors are still allowed to create subpages in an ad hoc fashion and there is no systematic approach to the architecture of enterprise knowledge.

## Content Repository and APIs

An experienced architect or administrator will ask of any content technology what the repository looks like. This is a good approach, because they are concerned about back-up, compatibility, performance, and a raft of similar issues.

Wikis have traditionally taken a very simple approach to information storage. Original wikis stored content in plain text files written with a wiki markup language. When a reader requested a page, the page was rendered. This was not speedy, but it worked. These days, wiki packages employ one of several different back-ends, with many housing their content in databases.

A transcendental consideration is whether the software supports automatic back-ups (commercial wiki applications often do). Another thing to think about is what this means in terms of integrating wiki content with content managed by other systems. For example, should an enterprise search system be able to index wiki content, and should the indexed content be raw wikitext, or rendered HTML pages?

This question leads on to the issue of wiki APIs, which, in fact, very few wikis have.

## Templates

When a wikitext page is required, it is rendered as HTML in a two-part process. First, the wiki markup is converted to HTML, and links are created between pages. Then, this content is wrapped by a template that provides a consistent look to all the pages in the wiki.

Comparing wikis to a CMS, most wikis have template systems that are very simple, often only enabling one general template for the entire site. Wiki templates (and page rendering in general) are often not cached, so the page is rendered with each request. From an enterprise perspective, a lack of caching can obviously limit system scalability. On the other hand, there is no finicky caching mechanism to deal with.

## Workflow

Wiki software completely changes the main idea of a workflow. Wikis are decentralized

and typically lack the controlling mechanism of a workflow system with a formal approval process. Wikis workflow systems often lack sophisticated and disaggregated and approval processes is commonly considered a feature and not a fault of wikis. This is contrary to the basic idea of many CMS, which prioritize control over empowerment. Despite this decentralized approach, there is one important thing to remember: the main idea that anyone can edit content is only a general policy and not an inherent characteristic of wiki software.

### Control vs. flexibility

There is a traditional trade-off between control and flexibility in information systems software. Decision-making is centralized by some sort of editor that verifies and approves content prior to publishing in a traditional CMS. With a wiki, the writer writes then publishes without editorial oversight or approval. This direct channel to publication is what makes wikis so wonderful in scenarios that emphasize speed and flexibility.

An important issue to deal with is what possibilities there are if enterprises want to exercise at least some control. In the absence of workflow controls, content creation in a wiki is managed through change monitoring, automated spam prevention, and user access control. Let us look at each one in turn.

### Change Monitoring

One simple defense mechanism is to monitor changes in the wiki and enable the rolling back to a previous version through versions control.

Recent changes can be monitored as follows:

- Most wikis have a “Recent Changes” page that lists all the pages that have been changed.

- E-mail notification of changes or support for RSS syndication.
- If more than one person has been tasked with monitoring changes, some wikis offer the capability to track whether a recently changed page has been checked yet, reducing the chances of the work being done twice.
- More sophisticated systems identify and differentiate “trivial” changes from more substantive ones.

In addition to the above ideas, it is important to consider that people make mistakes and sometimes deliberately do things badly. Therefore, the ability to roll back changes is a necessity. Features to look for include capabilities similar to what you would find in a CMS, like the ability to roll back changes to the previous version, to compare different versions side-by-side or the use of diffs between versions so that specific differences between them can be easily identified.

### Spam Prevention

Another approach is to monitor the content of changes programmatically, that is, to manage spam prevention. This differs from user access control in the sense that it monitors wiki edits based on the content itself, or patterns of user behavior. Some systems can block access to IP addresses and URLs, or they can block the posting of individual changes based on restricting the use of certain words or phrases, using word lists or regular expressions, and blocking access based on excessive activity.

### User Access Control

Enterprise wiki usually means that it has user access control. An increasing number of wiki projects offer sophisticated **more granular level**

in user access control issues. Users and groups can be assigned rights to tasks such as reading, editing, writing to, and rolling back a resource to a previous version. There is a lot of variance among wiki packages in terms of how those rights are applied to the site. A less common but useful feature is the ability to restrict access to parts of resources. The most sophisticated enterprise wikis work with single sign-on security systems like Siteminder, or offer network and directory integration (e.g., LDAP and Active Directory) for user authentication and authorization.

Contrary to their reputation, wikis are CMS that can be managed efficiently. They simply take a different approach to content management by choosing to emphasize speed and flexibility rather than strict controls. In order to successfully implement a wiki software package you will need to look at workflow from a different perspective and be sure to select wiki software that provides the right level of content monitoring and access control for your organization.

## **Enterprise RSS**

RSS is a family of Web feed formats used to publish frequently updated digital content, such as blogs, news feeds, or podcasts.

End-users that receive data from this technological channel use programs called feed “readers” or “aggregators”, as follows. The user “subscribes” to a feed by supplying to their reader a link to the feed; the reader can then check the user’s subscribed feeds to see if any of those feeds have new content since the last time it checked, and if so, retrieve that content and present it to the user.

The initials “RSS” are variously used to refer to the following standards:

- Really Simple Syndication (RSS 2.0)
- Rich Site Summary (RSS 0.91, RSS 1.0)
- RDF Site Summary (RSS 0.9 and 1.0)

RSS formats are specified in XML (a generic specification for data formats). RSS delivers its information as an XML file called an “RSS feed,” “Webfeed,” “RSS stream,” or “RSS channel.”

Essentially, Web 2.0 is fully centralized in its conception. Why are skype, del.icio.us, or Flickr Web sites instead of protocols (as foaf is)? The reuse of Web 2.0 data is limited only to the hostside and only with the help of feeds are data able to break out from centralized sites (Hammond, Hannay, & Lund, 2004, pp. 1082-9873). Therefore, feeds and RSS are the key to a new data-distributed model in the Web 2.0, where data are disaggregated on the Internet, and RSS allows data, information, and remote events to be distributed to end-users through the Internet.

## **Content Tagging**

Content tagging is a growing Internet trend that empowers users to add their own contextual tags to Web content, information, or resources. Typically, as Gruber (2005) affirms, this results in excellent content categorization in a way that is relevant to the needs of users.

Tags are, therefore, Web page and/or database descriptors (e.g., title, author, language, date, subject) that are assigned to knowledge (e.g., information, Web content, distributed resource, etc.). One of their main purposes is to help people find information. Tags can be assigned to document descriptions (e.g., card catalog cards in a library) or they can be assigned to the documents themselves or both.

Tags can be assigned by document authors, information professionals, editorial assistants, or even by computer programs. Artificial intelligence programs are a fast and easy (but not always the most accurate) method of tagging. Information professionals can produce highly accurate and effective tags that take into account all the nu-

ances of language and subject matter, but there is a limited supply of people with these skills.

These tags are useful for creating an emerging user-centric categorization of content in a folksonomy (a user-generated taxonomy used to categorize and retrieve Web content). Folksonomic tagging is intended to make a body of information that is increasingly easy to search, discover, and navigate overtime. A well-developed folksonomy is ideally accessible as a shared vocabulary that is both originated by, and familiar to, its primary users. Two widely cited examples of Web sites using folksonomic tagging are Flickr and del.icio.us.

Folksonomies are developed in Internet-mediated social environments. Therefore, knowledge workers can discover who has created a given tag for a concept, and see the other tags that this person created. In this way, folksonomy users often discover the tag sets of another user who tends to interpret and tag content in a way that makes sense to them. The result is often an immediate and rewarding gain in the user's capacity to find related content. Part of the appeal of folksonomy is its inherent subversiveness: when faced with the choice of the search tools that Web sites provide, folksonomies can be seen as a rejection of the search engine status quo in favor of tools that are created by the community.

Folksonomy creation and searching tools are not part of the underlying World Wide Web protocols. Basically, these folksonomies arise in Web-based communities where special provisions are made at site level for creating and using tags, as in del.icio.us. These communities are established to enable Web users to label and share user-generated content or to collaboratively label existing content. Since folksonomies are user-generated and therefore inexpensive to implement, advocates of folksonomy believe that it provides a useful low-cost alternative to more traditional, institutionally supported taxonomies or controlled vocabularies like enterprise IT solutions. An employee-generated folksonomy could therefore

be seen as an "emergent enterprise taxonomy." Some folksonomy advocates believe that it is useful for facilitating workplace democracy and the distribution of management tasks among people actually doing the work.

As many authors note in blogs and articles, "workplace democracy is also seen as a utopian concept at odds with governing enterprise reality, the majority of which exist and thrive as hierarchically-structured corporations not especially aligned to democratically informed governance and decision-making." Also, the folksonomy may facilitate workflow, but it does not guarantee that the information worker will tag and, then, tag consistently, in an unbiased way, and without intentional malice directed at the enterprise.

### Strategic Sensemaking

The increased importance of sensemaking will prove to be one of the central drivers for Enterprise 2.0 technologies adoption. The organizational theorist Karl Weick says that sensemaking is a central task in new organizations. Dan Russell at Creating Passionate Users provides a definition of sensemaking that will serve as a useful starting point: "Sensemaking is in many ways a search for the right organization or the right way to represent what you know about a topic. It's data collection, analysis, organization and performing the task" (Dervin, 1983).

Sensemaking can be a solution for constructing sensible accounts out of ambiguous, ambivalent, equivocal, and conflicting data in organizational settings for managers and leaders in the knowledge organization and management. In a world characterized by significant technology and strategic change, the problem of sensemaking becomes more acute.

One of the attractions of Enterprise 2.0 technologies is that they make business strategies more feasible and scalable. Most of the technologies depicted in this section

take participation as far as what face-to-face methods can support. They make it possible to generate and organize more extensive raw materials and inputs to planning/sensemaking processes. Wikis with good version tracking and refactoring capabilities make it both safer and easier to generate and work through alternative representations/sensemakings. Realizing this sensemaking potential will require brokering some introductions and partnerships. Those adept in the techniques are likely not to be versed in the ways that the technologies reduce or eliminate some of the key barriers to successfully using the techniques. Those who understand the technologies may not be aware that the techniques exist, much less that they could benefit from technological improvement. One starting point is to investigate the sensemaking planning techniques and practices and map points where the technologies enable, simplify, or improve the techniques for those promoting Enterprise 2.0 technologies.

### Social Networking

Nohria and Eccles (1992) give a common definition of social network as “a social structure made of nodes (which are often organizations or individuals) tied by one or more specific types of relationships, such as values, visions, idea, financial exchange, friends, kinship, dislike, trade, web links, etc.”

Social network analysis approach consists of relations in terms of *nodes* and *ties*. Nodes are actors within the networks, and ties are the relations between the actors. There can be many kinds of ties between the nodes. Research in a number of academic fields has shown that social networks operate on many levels, from families up to the level of nations, and play a critical role in determining the way problems are solved,

organizations are run, and the degree to which individuals succeed in achieving their goals.

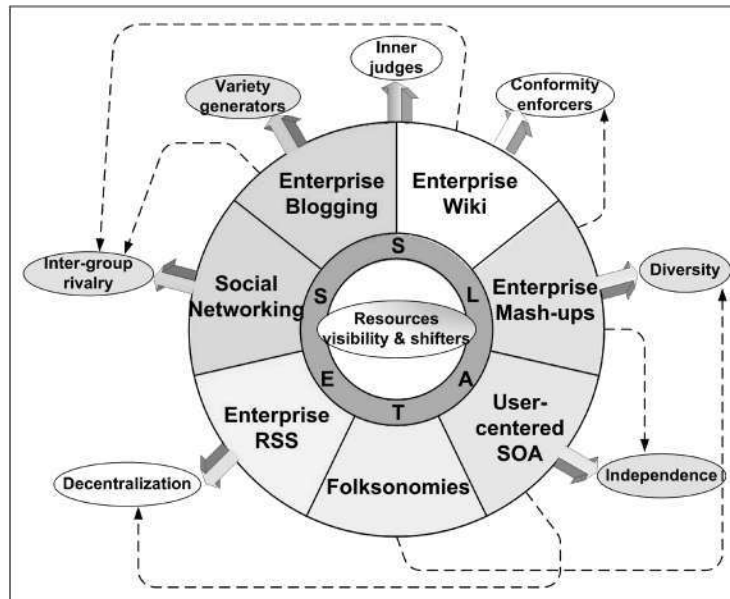
A social network is a map of all of the relevant ties between the nodes being studied. The network can also be used to determine the social capital of individual actors. These concepts are often illustrated by means of a social network diagram, where nodes are the points and ties are the lines. In traditional social network communities, an initial set of founders sends out messages inviting members of their own personal networks to join the site. New members repeat the process, adding to the total number of members and links in the network. Sites then offer features, such as automatic address book updates, viewable profiles, the ability to form new links through “introduction services,” and other forms of online social connections. Social networks can also be organized around business connections, as in the case of LinkedIn.

The combination of networking is a new point of view to social networking that combines both off-line elements (face-to-face events) and online elements. The newest social networks on the Internet are becoming more focused on niches such as travel, art, and so forth. Other social networking sites focus on local communities, sharing local business, and entertainment reviews, news, event calendars, and happenings.

Traditional social networks on the Internet were public, and any user could participate. However, large enterprises and organizations also have access to private social networking applications often called enterprise social networking software. For example, Microsoft released an enterprise social networking application in the form of a free add-on for Microsoft Office SharePoint Server called Knowledge Network (currently in beta) in February 2007. Organizations install these applications on their own servers and enable employees to share their networks of contacts and relationships to outside people and companies.



Figure 3. Enterprise 2.0 technologies: Innovation fostering framework



### Aligning the Business Strategy with Enterprise 2.0 Ground Rules, Driving Forces and Best Practices

Figure 3 shows a subset of the main Enterprise Web 2.0 technologies described throughout this chapter and what innovation promoting factors are fostered by each technology or ideology. Generally, each Enterprise 2.0 approach follows the SLATES principle described by McAfee. In addition, one of the most important innovation factors described in high-level knowledge working, that is, resources and content visibility through the Web and its simple modification and reedition in a shifting of resources is fostered by all technologies in the framework.

- Enterprise Wiki is used to input common descriptions and definitions of main business concepts. Everyone in the company can bring his or her own experience and knowledge to

bear to find, evaluate, and improve a content resource. This iterative process enforces common data and knowledge conformity across the enterprise. Each knowledge worker must review the wiki concepts and will use an inner judge of the content to do his or her best to improve the concepts. In addition, this phenomenon shows group and department knowledge outputs, allowing the management of constructive intergroup rivalry in order to improve the descriptions of concepts or knowledge about business processes.

- Enterprise blogging is useful for keeping a track on ideas, concept redefinitions, or business process information on a time line. This visibility stimulates each knowledge worker to discuss this information, generating a variety of ideas in an approximate definition cycle. Obviously, this technology, as the wiki approach, fosters the ideas of judgment and inter-group rivalry through the contribution

of their own experiences. Therefore, wiki and blogging together can tackle the emerging knowledge, social capital, and collective enterprise intelligence created by the groups of knowledge workers.

- The social networking idea promotes the rivalry and communication between enterprise employers in a social net, using several communication channels to increase the dialogue in the enterprise and its departments.
- Enterprise mash-ups deal with the diversity of solutions to a definite problem within the enterprise. Software solutions based on a heterogeneous merge of separate components communicated and parameterized by knowledge workers fosters diversity and originality in the enterprise, eliminating barriers to the innovation bloom. This approach also helps to enforce conformity in the enterprise about systematic knowledge, that is, what mash-up solution is the best to afford a particular solution for a business process. Users follow a “do-it-yourself” ideology that encourages the independence of end-users from the service providers and legacy.
- Global (user-centered) SOA mainly fosters the idea of the independence of end users and end-user innovation from the content and services providers, breaking down traditional innovation barriers in SOA approaches. In addition, it motivates a decentralization of resources across the Web, fostering client-computation and disaggregated data models and composition against the service traditional front-end.
- Enterprise RSS can manage the decentralization of data in Web 2.0 and Enterprise 2.0. Feeds and RSS are the keys of a new data-distributed model where data are disaggregated in Internet, and RSS is useful for distributing data, information, and remote events to end users through the Internet.
- Finally, folksonomies are related to the visibility of resources, and resources discovery and recommendation issues. The use of a relaxed taxonomy based on tagging by end users improves the diversity of knowledge related to these resources, and the collaborative intelligence present in enterprises can be better emerged.

Table 1.

	Conformity & imitation	Social loafing & slack off	Coordination failures	Abstraction/ Fragmentat.	Idolatry of memory	Certainty
Enterprise Wiki	✗	✓	✗		✓	✓
Enterprise RSS	?	?	✓	✓		✗
Folksonomy	✓	✓			✓	✓
Enterprise Blogging	✗	✓	✓		✗	✗
Enterprise Mash-ups	✗	✓	✗	✗	✓	✗
Global SOA	✓	✗	✗	✓	✓	
Social Networking	?	?	✓			✗

Table 1 shows how the Enterprise 2.0 technologies are related to the factors that inhibit or slow down innovation.

These relationships are of three types: a technology can be appropriate for deleting a negative factor (shown in green), could cause this factor (shown in red), or must be applied very carefully because it can cause or delete a factor depending on its use.

Next these specific relationships between technologies and inhibit factors are depicted in more detail:

- An enterprise Wiki is useful for collaboratively editing contents through a Web platform. In this technology, a new content or concept would commonly be inserted to the wiki, imitating the description, structure, and form used in other previous concepts, that is, it leads to a negative conformity and imitation process without concern about enterprise integration. On the other hand, it is very simple to edit a concept or contribute with one's own experience and knowledge to a wiki. Therefore, this idea reduces social loafing and the slack-off caused by traditional complex content management systems. The wiki uses an iterative description of concepts, that is, a new edition overwrites the previous one and could cause coordination failures. Finally, a wiki content is usually anonymous and iteratively improved. For this reason, it is easy to eradicate the idolatry of memory in enterprise knowledge, constantly improving the contents and anyone in the enterprise to properly discuss the manager's ideas.
- Enterprise RSS is a communication channel to manage the decentralization of data in Enterprise 2.0. Therefore, some factors like conformity or slack-off depend on the content transmitted through the feeds.
- The RSS architecture, based on client aggregators and feed channels, decreases the coordination failures during contents accessing in the enterprise. In addition, this data communication channel, split into several different disperse channels merged in the client, is a correct way to deal with data and their abstraction and fragmentation. The negative part of RSS is that the data origin is known, and this could foster the feeling that data created by heads or managers and distributed by RSS are certain.
- Folksonomies can create informal taxonomies based on tags (anonymous or not) in a very simple way using a Web platform. A new concept is very quick to tag. Therefore, this technique decreases the conformity in the conceptualization and the social loafing surrounding tagging contents and applying knowledge. Each knowledge worker will use his or her own experience, refining the tags used, even if these tags have been imposed by managers. For this reason, the knowledge is extrapolated and transformed, and therefore social capital emerges as obsolete enterprise conceptualizations are forgotten.
- Blogging keeps a track of ideas (and their authors), concept redefinitions, or business process information on a time line. This technology often causes a conformity feeling among the personnel, imitating structures, ideas, natural language descriptions, and schemas during a new track of knowledge in other enterprise blogs (in fact, wiki could cause a parallel effect). As with wiki editing, it is so simple, friendly, and quick to edit a new comment, or to refine an idea that social loafing is evidently decreased. However, each contribution is logged and stored in a blog, which has several

consequences: coordination failures and overwrite issues are decreased but knowledge workers could be afraid of expressing their ideas in public or of arguing a traditional notion (provoking an idolatry of memory) or a leader's opinion.

- Enterprise mash-ups motivate software solutions based on a heterogeneous merge of separate components. A working mash-up often causes a conformity feeling in knowledge workers. Therefore, it is recommendable to force them to create their own solutions fitted to their own problems. In this same sense, nonprogrammer users should be offered a simple way to create mash-ups and reduce slack-offs. This approach may often cause coordination failures across departments, creating solutions to similar business problems. Likewise, this technique can foster a wrong abstraction level at solving problems, creating partial software solutions without considering the whole problem dimension. This approach can improve previous mash-up-oriented solutions in a very fast and simple way, reducing the traditional idolatry of previous software or enterprise solutions so harmful in business strategies. Finally, it is very dangerous to publish strict mash-up compositions as unique software solutions created by managers or specialized departments, because this could provoke an innovation barrier to new ideas or improvements to these solutions.
- User-centered SOA mainly fosters the idea of independence of end users and end-user innovation from the content and services providers, focusing on reducing conformity and imitation issues caused by the traditional rigid SOA approach. This idea must be applied carefully because it could foster a slack-off in

nonprogrammer users that have a poor perspective of Web services, or problems coordinating efforts in pragmatic developments. This issue can be easily improved using this approach and a mash-up orientation together. A strong point of this technique is the correct abstraction/fragmentation view of enterprise complex problems, coordinating or orchestrating user-centered services to tackle with whole problems through interface charts and storyboards linked to concrete workflows. One of the most important ideas is the high parameterization in enterprise services. This makes it easy to forget traditional memorized solutions, improving them in an adaptable way.

- The social networking is a general philosophy focused on improving effort coordination across a social group, fostering collective intelligence emergence and exploitation, reducing the possible coordination failures, and increasing outsourcing visibility. Like RSS, social networking can be considered a family of communication channels. Therefore, aspects like imitation, conformity, or social loafing depend directly on the content and the management of social information and knowledge. In this philosophy, it is harmful to introduce managers and manager-generated knowledge that can cause the social group concern and delimit its innovation process and evolution.

### Application to Other Key Business Web Strategy Areas

This section looks at each of the implications of the explained Enterprise 2.0 vision for communication and information sharing, knowledge management business intelligence and business

process management, and its application to key business web strategy evolution.

## High-Performance Collaboration and Community-Building

More and more often organizations tend to behave like dynamically reconfigurable networked structures that carry out their tasks through collaboration and teamwork. Effective teamwork is an essential part of any nontrivial engineering process, and collaborative capabilities are an essential support for these teams.

Traditionally, collaboration has been a means for organizations to do their work. As illustrated throughout this chapter, however, the context in which they do this work is changing, especially in regards where the work is done, how the work is organized, and who does the work, and with this the characteristics of collaboration. Work teams face sizeable collaborative challenges, for which they have need of tools that they can use to communicate and coordinate their work efficiently. These challenges have been tackled traditionally by profuse research in *computer supported collaborative work* (CSCW). CSCW has a great deal of drawbacks can be dealt with under the Web 2.0 vision. Web 2.0 has taken a step forward in this respect with the emergence of *social networking* and *communities*, where the emphasis is on *open source communities*.

*Open source communities* are one of the most successful—and least well understood—examples of high-performance collaboration and community-building on the Internet today. *Open source communities* began as loosely organized, ad hoc communities of contributors from all over the world who shared an interest in meeting a common need. However, the organization of these communities has proven to be very flexible and capable of carrying out all kinds of developments, ranging from minor projects to huge developments.

Businesses following the *Enterprise 2.0* vision can benefit enormously by learning what open source communities are and how they work. It is important to remember how the use of the *Enterprise 2.0*-based IT infrastructure will transform today's Intranets into virtual spaces where all project stakeholders, possibly distributed in time and space, can negotiate, brainstorm, discuss, share knowledge and resources, and, generally, work together to carry out some task. The vision presented in previous sections will help to definitively change Tom Allen's well-known "30-meter" rule, stating that two scientists or engineers whose desks are more than 30 meters apart have a communication frequency of almost zero.

## Collaborative Knowledge Emergence and Management

The concept of knowledge management introduced previously has been an elusive chimera to corporations since the mid-1990s. Ever since employees came to be seen as knowledge workers, companies have been searching for ways to capture and disseminate the stuff inside their heads. Knowledge management systems have traditionally tried to do this by both relying on distributed production and providing high commonality. This way, they have sought to elicit tacit knowledge, best practices, and relevant experience from people throughout a company and put this information in a widely available database.

Nevertheless, a corporation's knowledge is scattered across a multitude of communication media channels, including e-mail threads of conversation, instant messaging talks, and communication media platforms or Intranets, corporate Web sites, and information portals. Production in the first group is distributed (that is, knowledge workers can create and distribute digital information free of charge), and many of them leave communication traces

(e.g., instant messaging talks or e-mail threads of conversation). However, the degree of commonality of this information is low (e.g., only the participants in an e-mail exchange have access to the knowledge held in the thread of conversation). In the second group, commonality is high, but production is centralized and visits to platforms leave no traces. Both the “low commonality” factor in current channels and the “centralized production” and “lack of traces” factors in current platforms imply that most knowledge work practices and output are invisible to most people in most companies. For this reason, it is very important to understand the presented vision and especially how *Enterprise 2.0*-based IT introduces new channels and platforms that enable distributed production, communication tracing, and high commonality of information and services simultaneously to improve user productivity in the way explained in the framework of Enterprises 2.0 technologies and their application to innovation, knowledge emergence, and content visibility.

On the other hand, current knowledge-work-specific technologies, like highly structured knowledge management systems using complex taxonomies and/or ontologies are not doing a good job at capturing, sharing, and applying their knowledge, which is typically highly unstructured and textual. In this respect, a recent study (Morris, 2005) has shown that only 44% of respondents agreed that it was easy to find what they were looking for on their Intranet. The channels and platforms in traditional use are not much good at providing answers to questions like who is working on a similar problem right now. Or what is the right way to approach this analysis? The presented practical Enterprise 2.0-based collaborative (and social) approach can catalog and search knowledge so that employees can

easily leverage it throughout the firm. Briefly, the application of the broad spectrum of Enterprise 2.0 of technologies to business Web strategy should be considered.

Finally, most current platforms, such as knowledge management systems, information portals, Intranets, business process management (BPM), business activity monitoring (BAM), and workflow applications are highly structured from the start, and users have little opportunity to influence their structure or to customize their functionality and their interfaces. Emerging platforms, like wiki, blogging, or folksonomies (explained throughout this chapter), for generating, sharing, and refining information under the Enterprise 2.0 vision umbrella focus not on capturing actual knowledge, but rather on knowledge workers' practices and output.

In conclusion, the Enterprise 2.0 vision is significant in this respect because it can potentially knit together an enterprise and facilitate knowledge work in ways that were out of the question before. Putting it simply, Enterprise 2.0 technologies have the potential to make the knowledge management infrastructure of a corporation what the Internet already is, that is, an online platform with a constantly changing, searchable structure built by distributed, autonomous, and largely self-interested peers. Technologies like blogs, wikis, and labeling systems capable of emerging folksonomies make a decisive contribution to the elicitation of knowledge, best practices, and relevant experience that is scattered across the corporation and make this information trustworthy, searchable, and accessible to people throughout a company, at the same time as creating a cooperative and helpful culture capable of boosting knowledge production and guaranteeing convergence and quality through highly egalitarian collaboration.

## Social Network Analysis and Business Intelligence

Howard Dresner, a Research Fellow at Gartner Group, popularized the term business intelligence as an umbrella term to describe a set of concepts and methods to improve business decision making using fact-based support systems. This discipline aims to describe how end users could access and analyze information stored on their company systems in order to provide a better understanding of the business and its customer. To do this, they used a broad category of applications and technologies for gathering, providing access to, and analyzing data from the earlier business activities for the purpose of helping enterprise users make better business decisions.

Much of the early research in this field took place before the widespread use of the Internet and even corporate e-mail. We now need to understand the implications of Enterprise 2.0 technologies in the process of sharing business intelligence (Barquin, 2006). Web 2.0 can be seen (as it has been explained previously) as the ability to communicate and share knowledge with other participants that have similar interests, resulting in a key means of producing, communicating, and sharing business intelligence. In this line, this chapter focused on describing how Enterprise 2.0 can be used to spread, publish, and manage data from previous business activities through a new breadth of collaborative social knowledge networking tools like blogs, wikis, messaging, e-mail channels, and so forth, improving the added value outlined in enterprise business intelligence.

In previous sections, we showed how the Enterprise 2.0 vision introduces new channels and platforms that enable distributed production, communication tracing, and high commonality of information and services simultaneously. Apart from making information and knowledge work practices and outputs far

more visible to the entire company, another key advantage pointed out during the chapter is that it can be used to carry out *social network analysis of business intelligence*. This is primarily concerned with the paths that information exchanges take between individuals and the fact that some individuals act as key nodes in the network and become critical factors in the successful communication and sharing of business intelligence.

*Social network analysis* allows us to identify the pathways that *business intelligence* must travel if it is to be used, integrated, enriched, and applied by individuals within enterprises. It will help to identify which the critical nodes are. Star nodes usually represent key points in the routing at which important intelligence can be either effectively tunneled to other network members that share the same interests or are working on the same type of problems or tragically choked, as we have seen up to now. Star nodes have been identified in almost any work environment grouping knowledge workers. Social network analysis is a powerful tool for improving a company's intelligence capabilities. Therefore, business intelligence analysis should be carried out not only on the content of communications, but preferentially on the structure of the social network, its topology, communication patterns, and links to identify the key nodes.

## Business Process Management Revisited

Finally, BPM represents another key area in which Enterprise 2.0 vision will help to make great improvements. It is generally accepted that the current orchestration, BPM and workflow systems and technologies have failed to achieve a seamless automation and integration of business processes. Although there are currently a lot of approaches and standards in this respect, none of them seems to offer a sound solution to real

enterprise needs. Most of the problem lies in how they handle the knowledge acquisition process for automating business operations. As we have seen, *Enterprise 2.0* provides a new approach to this problem that integrates flexibility, human interaction, and modeling facilities (different from the flowchart-based or the algorithmic approaches, and now based on networks of resources and interrelationships). Following the exposition carried out it is simple to find out the need to apply the Enterprise 2.0 approach to improve and evolve this kind of systems.

## CONCLUSION AND FUTURE TRENDS

In this chapter we have explored emerging Internet technologies, highlighting their potential for supporting business Web strategy as companies' reliance on new Web-based technologies to capitalize on new business opportunities increase quickly. Specifically, Enterprise 2.0 has been presented as a key enabler for businesses to expand their ecosystems and partnerships, as well as acting as a catalyst for improving innovation processes and knowledge work in general. On the one hand, we have elaborated on the concept of Enterprise 2.0 mash-up as the main technological enabler of a global, user-centered SOA that spans company boundaries. On the other hand, we have discussed the most relevant Enterprise 2.0 models and tools suitable for fostering emergent collaboration and cocreation, thus enabling firms to leverage desirable attributes, including harnessing collective intelligence and organization by participation.

The key idea behind the Enterprise 2.0-based approach to a business Web strategy, and the lesson many businesses must learn, is that next generation IT systems must be conceived to acquire the knowledge they operate on directly from who really has it, that is, the employees (seen as knowledge workers) and from the operation and communication processes employees enter into.

The knowledge of a business has less to do with the IT infrastructure than with the employees themselves. The IT infrastructure must be capable of extracting and managing that knowledge in order to evolve and adapt it to the business processes, and finally to the business strategy. Any other means to model and exploit the business knowledge will never be flexible enough. If user knowledge changes (and it does change), both the IT infrastructure and the business strategy must seamlessly adapt to such changes.

Future work would concentrate on evolving practical Enterprise 2.0 frameworks, as open source packages of technologies, tools, and platforms that build on all the key technical and theoretical enablers described above and on the proposed model of collaboration and enterprise knowledge emergency. We expect this framework and its pragmatic application could have great research opportunities within the domain of the topic.

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## ENDNOTE

- <sup>1</sup> Note that we are not talking here about things like agile development or eXtreme programming, because the target audience is the knowledge workers not a development team.