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What do wikis, blogs, podcasts, social networks, virtual worlds, and the rest do for corporate productivity and management?

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Business Impact of Web 2.0 Technologies

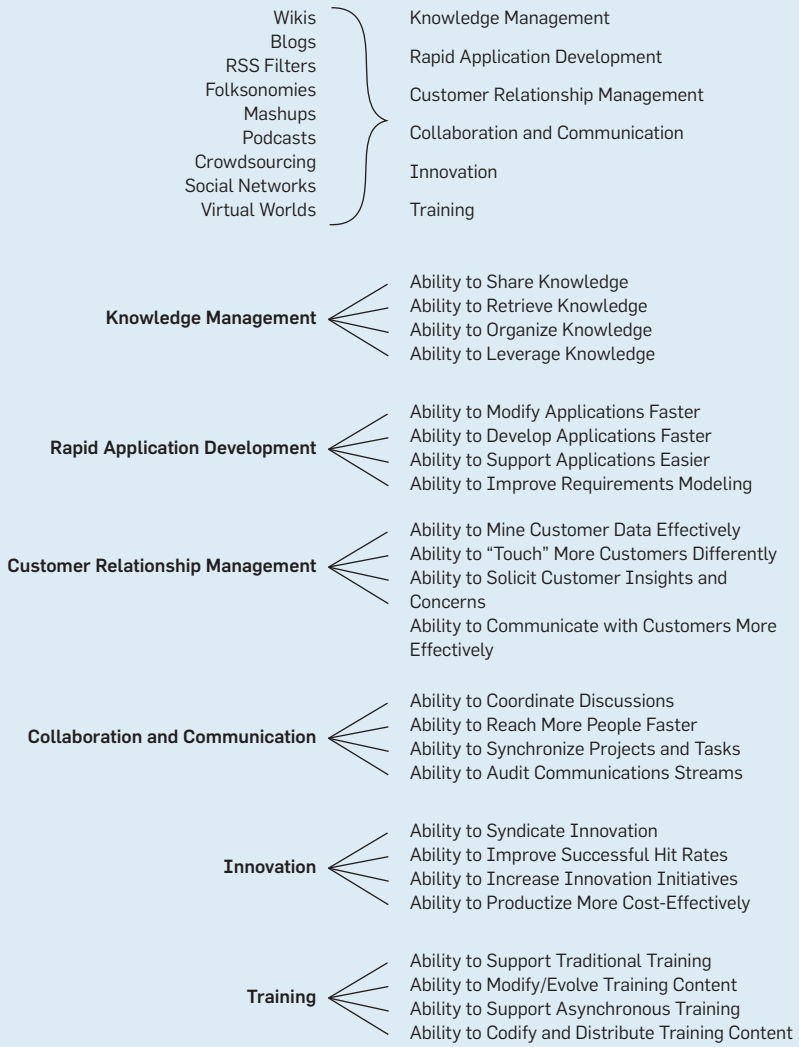
THIS ARTICLE DESCRIBES research designed to measure the impact of the business value of wikis, blogs, podcasts, folksonomies, mashups, social networks, virtual worlds, crowdsourcing, and RSS filters—all Web 2.0 technologies. Properly deployed, they may well permit companies to cost-effectively increase their productivity and, ultimately, their competitive advantage; the research reported here includes results of interview, observation, and survey data-collection from select companies and industries primarily in the U.S. across six performance areas: knowledge management, rapid application development, customer relationship management, collaboration/communication, innovation, and training. The results include caution, skepticism, and a significant contribution to collaboration and communication. Wikis, blogs, and RSS filters have had the greatest impact, while virtual worlds have had virtually none. Security remains a concern, but we found that communication and collaboration are generally well served by Web 2.0 technologies.

Only limited published research is available today exploring the contribution of Web 2.0 technologies to

» key insights

- **Web 2.0 technologies can help improve collaboration and communication within most companies.**
- **These technologies should be assessed to determine real impact, and a number of assessment techniques, including interviews, observations, and surveys, can be used to measure impact over time across multiple business areas.**
- **These technologies can help improve collaboration and communication across multiple vertical industries, though many companies are cautious about deploying them.**

Figure 1. Impact metrics.



corporate productivity and management. Gartner Group (http://www.gartner.com), Forrester Research (http://www.forrester.com), IDC (http://www.idc.com), and the Cutter Consortium (http://www.cutter.com) report that Web 2.0 technologies are rapidly making their way into corporate technology infrastructures and architectures. But the way they are used and the impact they are having have not been reported in a systematic way.

My research posed the following questions to managers and executives:

- What good is Web 2.0 technology to your company?;
- What problems might Web 2.0 technology solve?;
- How can we use the technology to save or make money?; and
- What are the best ways to exploit the technology without complicating existing infrastructures and architectures?

Research objectives included:

- Understand which Web 2.0 tools and techniques are most likely to improve corporate productivity and management;
- Identify how Web 2.0 tools and techniques can be used to enhance corporate productivity and management; and
- Measure impact via collection of interview, direct observational, and survey data.

Questions addressed included:

- Can wikis, blogs, RSS filters, and folksonomies help companies improve their knowledge management?;
- Can wikis be used to build "corporate encyclopedias," training manuals, and other forms of documentation?;
- Can blogs be used to vet ideas about markets, customers, and strategies?;
- Can podcasts be used to document products?;
- Can folksonomies be used to organize structured and unstructured content?;
- Can RSS filters be used to create content streams to improve customer relationship management?;
- Can mashups be used for rapid application development?; and
- Can crowdsourcing be used to stimulate innovation?

Research methods included:

- Profile the range of Web 2.0 technologies available to corporations;
- Define "impact" across multiple dimensions of productivity;
- Collect data on the use of Web 2.0 technologies and the impact areas through interviews, direct observation, and surveys;
- Analyze the data to identify usage patterns and impact;
- Identify correlations from the survey data among technologies and impact areas; and
- Measure the relative impact of individual and groups of technologies on individual and groups of impact areas.

(Figure 1 outlines specific impact metrics.)

Business 2.0, *Fast Company*, *Businessweek*, and other business publications cover Web 2.0 and even Web 3.0, the so-called "new Net" and the next digital gold rush. Is it indeed another bubble, with Web 2.0 (then Web 3.0) vendors crashing and burning like their dot-com predecessors a decade ago? The online trade journal *Web 2.0 Journal* (http://www.web2journal.com) explores all sorts of Web 2.0 technologies, while just about every major technology vendor has released multiple white papers on the promise of Web 2.0 technologies and applications. There are also many Web 2.0 blogs, including Dion Hinchcliffe's Web 2.0 (http://www.web2.socialcomputingmagazine.com), that attract a

growing number of participants. If this were 1999, we'd call Web 2.0 a "killer app" or "disruptive technology." However, we're still not sure today about the business impact of Web 2.0 technologies, which have evolved on the consumer-to-consumer side of the Web. Social networking sites like MySpace (http://www.myspace.com), Facebook (http://www.facebook.com), and Friendster (http://www.friendster.com) were developed to connect individuals anxious to share experiences, photographs, videos, and other personal aspects of their daily lives. These sites grew rapidly with huge amounts of user-created content; YouTube (http://www.youtube.com) is probably the best example of such content.

Our research reflects corporate deployment trends and business impact. Will Web 2.0 technology be widely adopted because it dramatically and cost-effectively improves corporate performance? Will it ultimately disappoint the business and technology professionals it's expected to please?

Interview Questions

The questions we posed to participating companies and that defined our observation included:

- How did you become aware of the availability of Web 2.0 technologies?;
- What is your understanding of how Web 2.0 technologies might positively affect productivity?;
- What is a great Web 2.0 productivity scenario for your company?;
- What's a really bad business scenario for your company trying to exploit Web 2.0 technologies?;
- Which Web 2.0 technologies have your company piloted?;
- Which Web 2.0 technologies have you avoided, and why?;
- What is their impact?;
- How would you quantify the impact of Web 2.0 technologies in the following areas: knowledge management, rapid application development, customer relationship management, collaboration, communication, innovation, and training?;
- What is your company's greatest success with Web 2.0 technologies?;
- What is your company's greatest disappointment?;
- What excites you most about Web 2.0 technologies?;
- What worries you most about investing in these technologies?;
- Which infrastructure or architecture issues worry you most?;
- Does business acceptance worry you?;
- Does IT acceptance worry you?; and
- Where do you think your company will be with Web 2.0 applications in the next three years?

These questions guided our interviews and observation exercises. Our conversations were designed to understand what companies were doing with Web 2.0 technologies, their impact, and their alignment with expectations, fears, and trends. They assumed that companies are in the relatively early stages of their Web 2.0 application deployment, are still learning what the technologies can and cannot do, and are motivated to understand their potential.

Figure 2. Summary interview findings.

	Internally Focused Applications	Externally Focused Applications
Collaboration/Communication	The majority of Web 2.0 technology applications are in this area. Viewed as "safe," they allow companies to pilot them while testing impact on security, infrastructure, total cost of ownership, and intellectual property.	Early adopters pilot Web 2.0 technologies outside the corporate firewall to establish alternative communication and collaboration patterns with employees, suppliers, clients, and customers, permitting improved communication.
Knowledge Management	KM is a natural result of deployment of wikis, blogs, podcasts, and RSS filters. Formal KM tools are giving way to more informal Web 2.0 tools, a trend expected to continue.	KM will support externally focused organizations (such as those in the consulting and retail industries) before internally focused organizations formally adopt it, slowed by concerns over security, privacy, and intellectual property.
Rapid Application Development	Mashup and related technology is gradually replacing more traditional RAD technology. As more and more components, application programming interfaces, and widgets are published, more RAD progress will be made.	RAD tools and techniques will formalize for technology vendors and technology-driven companies and industries, as more and more components, applications programming interfaces, and widgets are published by direct publishers and third-party hosts.
Customer Relationship Management	CRM applications are slow to absorb the extensible abilities of Web 2.0 technologies internally and especially externally. It will take time for Web 2.0 technologies to be integrated with and extended from existing CRM technologies.	CRM is a natural partner for Web 2.0 technologies, especially such tools as RSS filters, podcasts, mashups and blogs. There are countless ways to leverage Web 2.0 technologies on behalf of customers and suppliers, but, due to deployment anxiety, such applications will lag.
Training	Companies increasingly use wikis, blogs, podcasts, and RSS filters for training and education. Their ease of use and participatory nature appeal to a growing number of companies. Relatively low cost helps.	Third-party training and education providers will leverage Web 2.0 technologies, integrating them into the already substantial online training and education industry. The tools will then be sold back to customers to improve learning of all kinds.
Innovation	Web 2.0 technologies have little impact on the innovation process. There are spotty innovation applications of crowdsourcing for R&D and selected applications of folksonomies, RSS filters, and mashups, but the area is generally not affected.	Web 2.0 tools, techniques, and especially attitudes will alter the innovation process in many industries by facilitating direct communication and collaboration among creators and buyers of new products and services, thus shortening the innovation life cycle.

Interviews

We undertook a number of interviews and conversations, combined with direct observation, to determine the deployment of Web 2.0 technologies and, more important, the impact they have on corporate productivity. Our conversations occurred in Q1 and Q2 2008 with companies in the pharmaceutical, chemical, real estate/mortgage, information technology, and financial services industries agreeing to in-depth interviews and access to the teams implementing select Web 2.0 technologies. The interviews were conducted with senior technology managers in each company. Approximately 15 senior managers participated in the interviews.

The five companies represented the following vertical industries:

Company A. Big pharmaceutical company;

Company B. Global chemicals company;

Company C. National real estate and mortgage company;

Company D. Global IT company; and

Company E. Large financial services company.

The questions we asked and the responses included:

▸ How did you become aware of the availability of Web 2.0 technologies?;

Big pharmaceutical company: "Reading; conferences, vendors, and IT staff";

Global chemicals company: "Vendors, IT staff, and business partners";

National real estate and mortgage company: "Vendors and IT staff";

Global IT company: "Competitors, industry publications"; and

Large financial services company: "Trade publications, industry organizations."

▸ What is your understanding of the range of Web 2.0 technologies that might positively affect productivity?:

Big pharmaceutical company: "Primarily blogs, wikis, and podcasts";

Global chemicals company: "Blogs, wikis, podcasts, and RSS";

National real estate and mortgage company: "Blogs, wikis, podcasts, and RSS";

Global IT company: "Blogs, wikis, RSS, and virtual reality"; and

Large financial services company: "Blogs, wikis, mashups, and tagging."

There are serious concerns about intellectual property, proprietary information, privacy, security, and control.

▸ What would be a great Web 2.0 productivity scenario for your company?

Big pharmaceutical company: "Very fast, cheap but productive applications";

Global chemicals company: "Easy to deploy with lots of payback";

National real estate and mortgage company: "Fast, cheap to deploy, with major productivity";

Global IT company: "Integrates well with existing technology"; and

Large financial services company: "Transparent but effective."

▸ What would be a really bad scenario for your company?"

Big pharmaceutical company: "Lots of distraction due to the technology";

Global chemicals company: "Expensive, time-consuming deployment that fails";

National real estate and mortgage company: "Loss of control of the technology";

Global IT company: "Exposure of company secrets"; and

Large financial services company: "Everyone playing around with this stuff when they should be working."

▸ Which Web 2.0 technologies have you piloted?

Big pharmaceutical company: "Wikis and blogs";

Global chemicals company: "Wikis and blogs";

National real estate and mortgage company: "Wikis, RSS, and blogs";

Global IT company: "Wikis, blogs, and RSS filters"; and

Large financial services company: "Wikis, blogs, and mashups."

▸ Which Web 2.0 technologies are you avoiding, and why?

Big pharmaceutical company: "Virtual worlds, stupid";

Global chemicals company: "Virtual worlds, no clue how they might help us";

National real-estate and mortgage company: "Virtual worlds and blogs, way too much data to control";

Global IT company: "Blogs and crowdsourcing, way too much proprietary data in them"; and

Large financial services company: "Social networks, way too distracting during work."

▸ What has been the impact of the

technologies?

Big pharmaceutical company: "Too early to tell, way too early";

Global chemicals company: "Suspicious of trade-offs between 'fun' and 'productivity'";

National real-estate and mortgage company: "Who the hell knows?";

Global IT company: "People seem to like them, but I don't know the real impact"; and

Large financial services company: "We are hopeful."

▸ How would you quantify the impact in knowledge management, rapid application development, customer relationship management, collaboration, communication, innovation and training?

Big pharmaceutical company. "Collaboration and communication is where the action is; this is the real impact we're seeing at this point; plus, there's a lot of user acceptance of wikis, blogs, and social networks; we're getting more formal with KM where wikis and blogs are being used to codify information and vet decisions; only doing a little with RAD and mashups, but that will come in time; same with CRM, where we plan to use the tools to better communicate with customers and suppliers; wikis are emerging as training tools; not too much yet with innovation; a little worried about crowdsourcing outside the firewall";

Global chemicals company. "Wikis and blogs have changed the way we communicate: they're easy and fast, and everyone can participate; KM is fast following improved communications and collaboration; the IT team is crazy about mashups; they are able to build applications very quickly for the business, so I'd say RAD has improved; CRM with external customers and suppliers is behind the other applications; we're a little leery of working outside the firewall with these tools; training is a natural; we're using wikis, blogs, and podcasts for training, with good results; still nothing with virtual worlds or crowdsourcing, a little too 'out there' for us";

National real estate and mortgage company. "We're all over these tools for data and content management; RSS filters are used internally and externally, and we tag everything for better search and access; communication and collaboration are obvious beneficiaries of the tool use; CRM is our next application, where RSS and other content will be provided to our customers; virtual worlds are not there for us yet, but we like wikis, blogs, and podcasts for training; they are cheaper and faster than hiring a training company; innovation is happening inside the company with crowdsourcing and blogs";

Global IT company. "Communication and collaboration have improved since we introduced some Web 2.0 tools; consumerization has definitely taken hold here; people, especially the younger ones, are simply extending their personal experience with the tools to the workplace without missing a beat; KM is just sort of happening on its own, repositories are being built without a formal project to do so; CRM is still not on our radar, though we're doing a lot of things internally we could provide our customers and suppliers; mashup technology is the fastest RAD technology we've ever seen; we're training with wikis and blogs, and the time savings are large"; and

Large financial services company. "Impact has been spotty; I separate fun from productivity; sure, everyone likes these tools, but I'm not convinced that the benefit is there yet;

Table 1. Web 2.0 technology deployment.

Which Web 2.0 technologies have you deployed? (Please select all that apply.)	Response Percent	Response Total
Wikis	62.2%	61
Internal employee blogs	48.0%	47
External customer blogs	20.4%	20
RSS filters	32.7%	32
Folksonomies/ content management	21.4%	21
Mashups	11.2%	11
Virtual worlds	1.0%	1
Internal crowdsourcing	6.1%	6
External crowdsourcing	4.1%	4
Internal social networks	25.5%	25
External social networks	17.3%	17
None	22.4%	22
Other (please specify):	5.1%	5

Table 2. Overall expectations.

How would you rate your expectations about the contribution that Web 2.0 technologies would make to productivity and management?	Response Percent	Response Total
High	23.7%	18
Medium	55.3%	42
Low	21.1%	16
None at all	0%	0

wikis and blogs help communication, especially collaboration, but I wonder just how much; we have so much to do, and even though Web 2.0 tools are pretty easy to use, they still require time and effort; we already have KM tools and databases that permit us to organize and search; we have CRM tools we've invested a ton of money in; we have contractors, vendors, and partners that assist our innovation efforts; and what about the negative impact on security?; we like the CRM aspects of the technologies, but I need to see empirical cost-benefit data before I declare victory."

▸ What is your greatest success with Web 2.0 technologies?

Big pharmaceutical company: "The ability to record knowledge and experiences in a single format and location";

Global chemicals company: "Internal buzz; everybody likes the new stuff";

National real estate and mortgage company: "Wikis are being used for training";

Global IT company: "Using crowdsourcing internally to solve some tough problems"; and

Large financial services company: "Building some RSS filters to better organize information; also using folksonomies to organize data and content."

Table 3. Expectations by impact area.

To which areas did you believe that Web 2.0 technologies would contribute to most? (Please select all that apply.)	Response Percent	Response Total
Knowledge management	78.9%	60
Rapid application development	22.4%	17
Customer relationship management	44.7%	34
Collaboration and communication	90.8%	69
Innovation	46.1%	35
Training	43.4%	33
Other (please specify):	2.6%	2

Table 4. Actual impact data.

To which areas have Web 2.0 technologies contributed the most? (Please select all that apply.)	Response Percent	Response Total
Knowledge management	53.9%	41
Rapid application development	17.1%	13
Customer relationship management	18.4%	14
Collaboration and communication	81.6%	62
Innovation	21.1%	16
Training	7.9%	6
Other (please specify):	2.6%	2

▸ What has been your company's greatest disappointment?

Big pharmaceutical company: "Seeing a lot of what I consider to be sensitive information in wikis, blogs, and podcasts";

Global chemicals company: "IT's inability to control this stuff";

National real estate and mortgage company: "No feedback on what it's good for";

Global IT company: "Lack of vendor support"; and

Large financial services company: "The caution of IT."

▸ What excites your company most about Web 2.0 technologies?

Big pharmaceutical company: "How easy it is to deploy new, useful technology";

Global chemicals company: "How we can displace more expensive technologies for much cheaper and easier-to-use technologies;

National real estate and mortgage company: "How easy it is to use the new stuff";

Global IT company: "How open it is"; and

Large financial services company: "How it extends existing capabilities."

▸ What worries you the most?

Big pharmaceutical company: "Integration with existing technologies";

Global chemicals company: "Integration with business processes";

National real estate and mortgage company: "Support";

Global IT company: "Intellectual property and privacy, a lot"; and

Large financial services company: "Security, privacy, IP, and all of the proprietary data that fills wikis, blogs, crowdsourced solutions, podcasts, and everything else this technology makes transparent."

▸ What infrastructure or architecture issues worry you?

Big pharmaceutical company: "Security, security, and security";

Global chemicals company: "Support";

National real estate and mortgage company: "Governance. Who owns these tools?";

Global IT company: "Integration and interoperability with our applications"; and

Large financial services company: "Integration with our existing appli-

cations and architectures."

▸ Does business acceptance worry you?

Big pharmaceutical company: "Not at all, as long as it works and doesn't cost too much, they will embrace it";

Global chemicals company: "The business always wants to try new things; it's IT that slows things down";

National real estate and mortgage company: "The business is skeptical about all the new tools IT brings to the table, so they'll be cautious";

Global IT company: "The business wants only low-cost solutions"; and

Large financial services company: "If it's free and powerful, they'll love it."

▸ Does IT acceptance worry you?

Big pharmaceutical company: "Yes, they always find something 'wrong' with the new stuff, always worried about support";

Global chemicals company: "No, they are pushing the stuff";

National real estate and mortgage company: "Cost always worries IT; it's been beaten into them over time; so the technology needs to be cheap to deploy and support";

Global IT company: "They will come around; they don't like how easy it is for employees to just set up blogs and wikis, often end-running them"; and

Large financial services company: "They see the business value, or at least the potential in these tools, so I think we are OK here."

▸ Where do you think you will be with Web 2.0 applications in three years?

Big pharmaceutical company: "Fully accepted and integrated";

Global chemicals company: "There, but you need to ask me about Web 3.0 technologies";

National real estate and mortgage company: "Mainstream by that time we will have figured out what to do with them";

Global IT company: "Well-received and productive"; and

Large financial services company: "Still a little skeptical."

Results. The interviews and direct observations revealed consistent trends among the interview subjects (see Figure 2). We learned that Web 2.0 technologies, in spite of the hype, are entering the enterprise slowly but deliberately. The exception is there are clearly applications not entirely controlled by the enterprise's technology organization. The majority of applications are entering organizations in areas where expectations can be managed, costs are low, and tool integration and interoperability (with existing applications and infrastructures) are manageable. We also learned there are serious concerns about intellectual property, proprietary information, privacy, security, and control.

Technology organizations are both advancing and delaying deployment of Web 2.0 technologies. Some absolutely require that Web 2.0 technologies, like all enterprise technologies, be governed by the same processes governing the acquisition, deployment, and support of all digital technologies. Others are loosening their grip somewhat, primarily because they believe it's virtually impossible to prevent business units and project teams from creating wikis and blogs.

There is also a hierarchy of Web 2.0 tools. All companies we interviewed deployed wikis and blogs, and many deployed RSS filters and podcasts.

Table 5. Knowledge management impact data by ability.

In the area of knowledge management, have Web 2.0 technologies contributed to your organization's ability to...	Not at all	Very little	Somewhat	A great deal	Response Total
Share knowledge	3.9% (3)	10.5% (8)	51.3% (39)	34.2% (26)	**76**
Retrieve knowledge	9.2% (7)	13.2% (10)	55.3% (42)	22.4% (17)	**76**
Organize knowledge	6.6% (5)	22.4% (17)	52.6% (40)	18.4% (14)	**76**
Leverage knowledge for problem-solving	13.2% (10)	31.6% (24)	35.5% (27)	19.7% (15)	**76**

Table 6. Web 2.0 technologies and knowledge management.

In terms of improving knowledge management, which Web 2.0 technologies have contributed the most? (Please select all that apply.)	Response Percent	Response Total
Wikis	69.7%	53
Internal employee blogs	30.3%	23
External customer blogs	10.5%	8
RSS filters	13.2%	10
Folksonomies/ content management	18.4%	14
Mashups	3.9%	3
Virtual worlds	1.3%	1
Internal crowdsourcing	2.6%	2
External crowdsourcing	0%	0
Internal social networks	14.5%	11
External social networks	7.9%	6
We have not seen any improvement in knowledge management.	7.9%	6
Other (please specify):	2.6%	2

Table 7. Rapid application development impact data by ability.

In the area of rapid application development, have Web 2.0 technologies contributed to your organization's ability to...

	Not at all	Very little	Somewhat	A great deal	Response Total
Modify applications faster	39.5% (30)	22.4% (17)	30.3% (23)	7.9% (6)	**76**
Develop applications faster	39.5% (30)	23.7% (18)	20.3% (23)	6.6% (5)	**76**
Support applications better	40.8% (31)	22.4% (17)	25.0% (19)	11.8% (9)	**76**
Improve requirements modeling	39.5% (30)	23.7% (18)	28.9% (22)	7.9% (6)	**76**

Table 8. Web 2.0 technologies and rapid application development.

In terms of improving rapid application development, which Web 2.0 technologies have contributed the most? (Please select all that apply.)	Response Percent	Response Total
Wikis	44.7%	34
Internal employee blogs	14.5%	11
External customer blogs	9.2%	7
RSS filters	6.6%	5
Folksonomies/ content management	5.3%	4
Mashups	6.6%	5
Virtual worlds	1.3%	1
Internal crowdsourcing	7.9%	6
External crowdsourcing	0%	0
Internal social networks	7.9%	6
External social networks	0%	0
We have not seen any improvement in rapid application development.	30.3%	23
Other (please specify):	7.9%	6

Fewer deployed social networks, mashups, and folksonomies, and even fewer invested in crowdsourcing and virtual worlds. Deployment momentum is at work, as it often is when new technologies appear. Momentum breeds momentum, and we can expect wikis, blogs, podcasts, and RSS filters to gain momentum as other Web 2.0 technologies lag. The models for exploiting these early-adopted technologies will thus grow faster, wider, and deeper than optimization models for, say, virtual worlds.

Finally, an important distinction separates internal applications from their external counterparts. We noticed that our companies were much more willing to pilot Web 2.0 technologies inside than outside their firewalls, not because they feared failure or wanted to avoid tipping their hands to competitors, but because of deepening concerns about security and access to corporate private data.

Our interviews provided one level of insight into the adoption and impact of Web 2.0 technologies, but what did the survey data provide?

The Survey

The survey questions focused on background issues, impact expectations, and the impact the technologies have across the six areas. The Cutter Consortium, a research and consulting organization, administered the survey to its stable of CIOs, CTOs, CFOs, CEOs, and COOs representing more than 20 vertical industries, including small offices/home offices, small and mid-size businesses, and large global enterprises. The five companies we interviewed also participated in the survey. In addition to these five companies, 93 companies from around the world also responded to the survey.

Results. Table 1 outlines the survey results, along with the deployment landscape. Wikis and blogs lead the charge, followed by RSS filters.[a] Perhaps surprising is the deployment of internal social networks and folksonomies/content management applications. No one seems to like living in a virtual world. The use of external customer blogs is also interesting and suggestive of our desire to reach out to customers any way we can. We must also acknowledge that 22% in the survey did not deploy any Web 2.0 technologies at all.

These results are consistent with our interview data. The most obvious Web 2.0 technologies, including wikis and blogs, are being deployed more rapidly than virtual worlds, crowdsourcing, and mashups. There's caution around early adoption of any new technology. Due to the freewheeling nature of Web 2.0 technologies, even more caution is apparent.

The growth of external deployment is important. We're seeing deployment of external blogs and external social networks, though we're lagging with deployment of external crowdsourcing models. This confirms the

a Wikis, blogs, and folksonomies reflect the ability to link data, information, and knowledge previously unlinked (see www.linkeddata.org). Web 2.0 tools "free" users from corporate restrictions on access, content, and transaction processing, so are both a blessing and a curse.

distinction we noted between the internal and external deployment of Web 2.0 technologies during our interviews (see Figure 2).

Table 2 outlines some expectations data. What did senior managers think about the contributions Web 2.0 technologies could make to corporate productivity and management?

The survey data suggests expectations were generally positive, even though most respondents (55%) expect "medium" impact, and 23% expect it to be "high." This combined 78% response suggests the majority of respondents expect the impact of Web 2.0 technologies to be significant. There is a lot of optimism out there.

Table 3 suggests that most respondents expect Web 2.0 technologies to affect knowledge management, collaboration, and communications; many also expected them to positively affect customer relationship management, innovation, and training. Rapid application development was expected to lag relative to the other areas.

Table 4 outlines what happened vs. what respondents thought would happen. For example, knowledge management was expected to be more important than it turned out to be. Collaboration and communications were slightly exaggerated in the expectations survey data, though collaboration and communications were still highly affected by Web 2.0 technologies. Expectations lagged for innovation, training, customer relationship management, and rapid application development. What could explain the optimism that yielded to reality? Cynics might point to pundit hype and vendor exaggeration of technology capabilities, something many vendors do routinely. Others might point to naiveté about early vs. managed-technology adoption processes. Regardless of the reason, we found a gap between what was expected and what actually occurred.

Table 5 shifts to a lower level of analysis, assessing the impact of knowledge management. The four metrics—sharing, retrieving, organizing, and leveraging knowledge—indicate that Web 2.0 technologies contributed significantly to sharing, retrieving, and organizing knowledge but less to leveraging knowledge for problem solving. This makes Web 2.0 technologies (for knowledge management) more descriptive than prescriptive, more operational than strategic.

The impact breakdown is even more interesting. Table 6 suggests that wikis, blogs, and folksonomies/content management lead the way toward improved knowledge management. A surprising finding is the relative lack of impact of RSS filters, because the essence of RSS filtering is knowledge management. Not surprising is that virtual worlds have little impact on knowledge management.

In terms of application development, relatively little ground-up appli-

Table 9. Customer relationship management impact data by ability.

In the area of customer relationship management, have Web 2.0 technologies contributed to your organization's ability to...	Not at all	Very little	Somewhat	A great deal	Response Total
Mine customer data more effectively	42.1% (32)	30.3% (23)	21.1% (16)	6.6% (5)	**76**
"Touch" more customers differently	34.2% (26)	28.9% (22)	22.4% (17)	14.5% (11)	**76**
Solicit customer insights and concerns	36.8% (28)	25.0% (19)	26.3% (20)	11.8% (9)	**76**
Communicate with customers more effectively	32.9% (25)	21.1% (16)	39.5% (30)	6.6% (5)	**76**

Table 10. Web 2.0 technologies and customer relationship management.

In terms of improving customer relationship management, which Web 2.0 technologies have contributed the most? (Please select all that apply.)	Response Percent	Response Total
Wikis	22.4%	17
Internal employee blogs	15.8%	12
External customer blogs	19.7%	15
RSS filters	10.5%	8
Folksonomies/ content management	11.8%	9
Mashups	6.3%	4
Virtual worlds	0%	0
Internal crowdsourcing	1.3%	1
External crowdsourcing	3.9%	3
Internal social networks	9.2%	7
External social networks	17.1%	13
We have not seen any improvement in customer relationship management.	28.9%	22
Other (please specify):	7.9%	6

cation development is going on these days. More and more companies have adapted their processes to those embedded in packaged software applications. Also, a great deal of application development occurs around the customization of functionality extending from packaged applications.

One would think mashup technology would have a dramatic impact on the customization and extension of packaged application-based functionality, an assumption not supported by our survey data. Table 7 suggests a weak relationship across the board between Web 2.0 technologies and application development. This finding also suggests that the new Internet-centered applications architecture may lag as well. While more and more transaction processing occurs outside the corporate firewall, many companies are more comfortable with older application-development enhancement methods and models that do not necessarily involve Web-published application program interfaces, components, and widgets.

Wikis seem to lead the pack of Web 2.0 technologies and their contribution to rapid application development (see Table 8). Wikis apparently represent a suite of new applications companies are deploying. Perhaps surprising is the relatively few survey respondents who view mashups as applications unto themselves or as an applications-development methodology. Web-centric application architectures will use mashup technology extensively to create a new class of applications, though they appear to be more on the drawing board than in the field.

Table 9 indicates that Web 2.0 technologies have had little impact on customer relationship management, a little surprising since several Web 2.0 technologies (such as external customer blogs, wikis, external social networks, and RSS filters) have great potential in this area. This further suggests that we may not be thinking creatively enough about how Web 2.0 technologies can contribute not only to customer relationship management but to other impact areas as well.

Table 10 suggests that wikis and external customer blogs contribute the most to customer relationship management, though, again, the numbers are not compelling. Little confidence was expressed in the use of external social networks. Overall, the data suggests that customer relationship

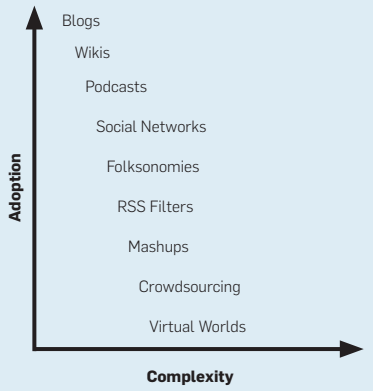
Table 11. Collaboration and communications impact data by ability.

In the area of collaboration and communication, have Web 2.0 technologies contributed to your organization's ability to...	Not at all	Very little	Somewhat	A great deal	Response Total
Coordinate discussions	10.5% (8)	10.5% (8)	55.3% (42)	23.7% (18)	**76**
Reach more people faster	3.9% (3)	17.1% (13)	50.0% (38)	28.9% (22)	**76**
Synchronize projects and tasks	13.2% (10)	22.4% (17)	56.6% (43)	7.9% (6)	**76**
Audit communications streams	30.3% (23)	31.6% (24)	32.9% (25)	5.3% (4)	**76**

Table 12. Web 2.0 technologies, collaboration, communication.

In terms of improving rapid application development, which Web 2.0 technologies have contributed the most? (Please select all that apply.)	Response Percent	Response Total
Wikis	67.1%	51
Internal employee blogs	42.1%	32
External customer blogs	11.8%	9
RSS filters	17.1%	13
Folksonomies/ content management	18.4%	14
Mashups	5.3%	4
Virtual worlds	2.6%	2
Internal crowdsourcing	6.6%	5
External crowdsourcing	1.3%	1
Internal social networks	25.0%	19
External social networks	13.2%	10
We have not seen any improvement in rapid application development.	9.2%	7
Other (please specify):	3.9%	3

Figure 3. Adoption and complexity.



management is not viewed as a prime impact area for Web 2.0 technologies, though this attitude might change over time.

Table 11 shifts the focus to collaboration and communication, where, as expected, the impact is significant. Wikis are the runaway hit, followed by blogs and external social networks. However, we found a lower level of deployment sophistication than the ideal. For example, the "auditing" of communications and collaboration streams (classic business intelligence) lags well behind other impact areas. The power of many Web 2.0 technologies often involves the ability to perform primary and secondary analyses of transactions, communications patterns, and customer service. Our survey data appears to indicate that we're seeing a toe-in-the-water effect, where companies experiment with initial deployments but stop short of full commitment through total exploitation of the technologies.

Table 12 confirms all this, with wikis, internal blogs, and internal social networks leading the way in collaboration and communications. While this trend is to be expected, many other opportunities have yet to be exploited. Table 12 also suggests weakness in externally focused Web 2.0 technology deployment—surprising in light of the technology's capabilities. We can infer from this data that external applications lag internal ones and that over time significant collaboration and communication applications can be expected. Why such optimism? Because Web 2.0 technology capabilities are essentially built on ubiquitous collaboration and communication.

Table 13 turns to innovation, though there's not much enthusiasm here, despite enough progress to excite those who think Web 2.0 technology can eventually contribute to innovation. Crowdsourcing is an especially powerful Web 2.0 innovation technology, along with RSS filters, wikis, and blogs.

Table 14 outlines how Web 2.0 technologies contribute to innovation. Very surprising is the relative unimportance survey respondents ascribe to external crowdsourcing. (Does anyone believe virtual worlds are useful for anything?)

Training is the final area we assessed. Table 15 suggests that survey respondents have not yet defined how Web 2.0 technologies can contribute to training. While wikis are natural-

Figure 4. Segmentation of Web 2.0 technologies.

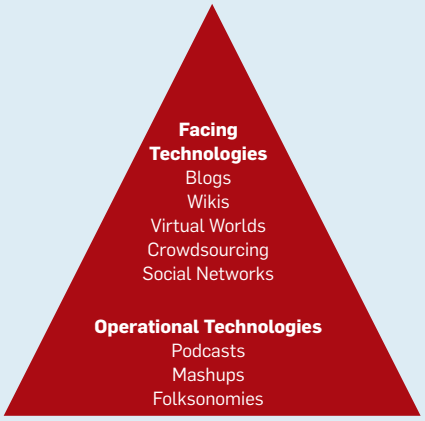


Table 13. Innovation impact data by ability.

In the area of innovation, have Web 2.0 technologies contributed to your organization's ability to...	Not at all	Very little	Somewhat	A great deal	Response Total
Organize innovation	27.6% (21)	22.4% (17)	39.5% (30)	10.5% (8)	**76**
Improve R&D success	36.8% (28)	15.8% (12)	35.5% (27)	11.8% (9)	**76**
Increase the number of innovation initiatives	35.5% (27)	19.7% (15)	31.6% (24)	13.2% (10)	**76**
Productize innovations more effectively	39.5% (30)	14.5% (11)	38.2% (29)	7.9% (6)	**76**

Table 14. Web 2.0 technologies and innovation.

In terms of improving innovation, which Web 2.0 technologies have contributed the most? (Please select all that apply.)	Response Percent	Response Total
Wikis	50.0%	38
Internal employee blogs	30.3%	23
External customer blogs	9.2%	7
RSS filters	9.2%	7
Folksonomies/ content management	10.5%	8
Mashups	5.3%	4
Virtual worlds	1.3%	1
Internal crowdsourcing	7.9%	6
External crowdsourcing	3.9%	3
Internal social networks	17.1%	13
External social networks	5.3%	4
We have not seen any improvement in customer relationship management.	26.3%	20
Other (please specify):	3.9%	3

born trainers, Web 2.0 technologies can contribute much more. What were the respondents missing? Table 16 provides the details. While wikis "win," other technologies are discounted, at least for now. Meanwhile, this is where virtual worlds might actually contribute to education and learning, though there's not much evidence to suggest that anyone agrees.

Interpretation

What did we learn from the interviews, observations, and survey? Security remains a major issue in the adoption of Web 2.0 technology. Beyond it, there's also internal control and prudence versus flexibility, even liability. Some companies block access to social networking sites from corporate networks; others are creating their own corporate social networking sites, though we found companies concerned about the amount of time employees spend on them.

Our interview, observation, and survey data all suggest the lowest-hanging fruit is—surprise!—picked first. Wikis, blogs, and social networks, perhaps due to their consumer-to-consumer origins, have been deployed more than the other Web 2.0 technologies. Fear of the unknown might explain why virtual worlds, folksonomies, crowdsourcing, and even RSS filters have lagged deployment of the wiki/blog/social network big three.

It also appears the survey respondents have not yet discovered the second-level potential of Web 2.0 technologies. Mashup technology is potentially extremely powerful but has not yet penetrated the rapid-application-development mind-set. Similarly, the customer-relationship-management mind-set is under-influenced by Web 2.0 technologies.

One important factor constraining adoption of Web 2.0 technology is the existing applications portfolio in companies with substantial technology budgets. In addition to the perennial issues around asset amortization, not-invented-here constraints restrict introduction of new applications based on new technologies. This walled-garden effect is real in many companies, restricting adoption of new technologies, applications, and even processes.

Some Web 2.0 technologies are operational, and some are employee- and customer-facing. Figures 3 and 4 suggest a relationship between complexity and adoption and an important distinction between operational and facing technologies. We should assume that simple (versus complex) facing technologies will be adopted more quickly than complicated operational ones.

Web 2.0 technology also fuels the broad area of information warfare. Just as cyberbullying is a nasty trend in the consumer world, anonymous blogging can hurt business, images, and brands. The number of incidents designed to harm companies (sometimes specifically targeted) is growing dramatically. Companies will have to increase their cybervigilance and invest in countermeasures. Web 2.0 technology also empowers disgruntled employees who might want to hurt their companies. Whistleblow-

Table 15. Training impact data by ability.

In the area of training, have Web 2.0 technologies contributed to your organization's ability to...	Not at all	Very little	Somewhat	A great deal	Response Total
Support traditional training	44.7% (34)	22.4% (17)	26.3% (20)	6.6% (5)	**76**
Modify and evolve training content	36.8% (28)	18.7% (15)	30.3% (23)	12.2% (10)	**76**
Suppport distance training	34.2% (26)	21.1% (16)	27.6% (21)	17.1% (13)	**76**
Distribute training content	35.5% (27)	19.7% (15)	35.5% (27)	9.2% (7)	**76**

Table 16. Web 2.0 technologies and training.

In terms of improving training, which Web 2.0 technologies have contributed the most? (Please select all that apply.)	Response Percent	Response Total
Wikis	40.8%	31
Internal employee blogs	21.1%	16
External customer blogs	10.5%	8
RSS filters	11.8%	9
Folksonomies/ content management	14.5%	11
Mashups	3.9%	3
Virtual worlds	2.6%	2
Internal crowdsourcing	2.6%	2
External crowdsourcing	0%	0
Internal social networks	14.5%	11
External social networks	5.3%	4
We have not seen any improvement in rapid application development.	28.9%	22
Other (please specify):	9.2%	7

ing promises to take on new forms through Web 2.0 channels.

As more Web 2.0 technologies are deployed, and as early impact is positively assessed, additional deployment and additional productivity can be expected. Momentum breeds momentum, and the second-order impact of the technologies will be felt as momentum grows. While "simple is good" today, "complex and powerful" will define tomorrow's deployment of Web 2.0 and 3.0 technologies.

Web 3.0 technologies should be anticipated. According to Wikipedia.org, Web 3.0 technologies include: "The emergence of 'The Data Web' as structured data records are published to the Web in reusable and remotely queryable formats. The Data Web enables a new level of data integration and application interoperability, making data as openly accessible and linkable as Web pages. The Data Web is the first step on the path toward the full Semantic Web. The full Semantic Web will widen the scope such that both structured data and even what is traditionally thought of as unstructured or semi-structured content (such as Web pages and documents) will be widely available in RDF and OWL semantic formats. Web site parse templates will be used by Web 3.0 crawlers to get more precise information about Web sites' structured content. Web 3.0 has also been used to describe an evolutionary path for the Web that leads to artificial intelligence that can reason about the Web in a quasi-human fashion."

Next-generation Web technology will be proactive, intelligent, contextual, automated, and adaptive. While we examined adoption of Web 2.0 technologies, imagine the analyses of Web 3.0 technology adoption we'll eventually conduct. When technology integrates seamlessly into business processes at all levels we can expect impact to be immediate and dramatic. The full potential of Web 3.0 is years away, but the drivers of Web 2.0 technology adoption already provide clues to how ubiquitous Web 3.0 is likely to be.

Regardless of the reason, we found a gap between what was expected and what actually occurred.

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