

eBusiness Evangelist

The Center for eBusiness at the Massachusetts Institute of Technology has a clear-cut mission: To be the leading academic source of innovation in management theory and practice for e-business. Erik Brynjolfsson, director of the center, is responsible for making that mission a reality.

As the largest research program in the history of the MIT Sloan School of Management, the Center for eBusiness (<http://ebusiness.mit.edu>) brings together faculty and industry in research initiatives focused on Internet-enabled business. The center has conducted more than 60 research projects, ranging from the use of radio-frequency identification (RFID) and mobile commerce in the supply chain to B2B exchanges and reverse auctions.

In addition to his work at the center, Brynjolfsson is the Schussel Professor of Management at the MIT Sloan School of Business. Last year he was named one of the top five most influential academics in the field of business technology in a survey of business-technology professionals conducted by Optimize Power Research.

For Brynjolfsson, productivity and competency in e-business are inextricably linked. The leaders fully understand this, he says. The followers need to develop this same understanding—fast. *SCMR* Editor Francis J. Quinn spoke with Professor Brynjolfsson at his offices at MIT in Cambridge, Mass.

Q: *What's your definition of e-business?*

A: At the Center for eBusiness at MIT we think of e-business fairly broadly to include not only the use of Internet but also related technology for communication and information processing. In particular, we're looking at how these technologies are changing the way business is done. It includes e-commerce, but it also includes the internal changes companies are making and certainly the relationships with their customers and suppliers as well. We work with a lot different technologies, but our real focus is on the business process changes and strategy changes that go with using these technologies. Our broader theme has to do with management and business process for strategic changes that accompany new technologies.

Q: *You're an advocate of getting the right processes in place first and then getting the appropriate e-business technologies to support those processes?*

A: Right. My own research has found that for every dollar that companies spend on hardware—on new technology—they spend \$9 or \$10 on what we call organizational capital and human capital. That includes investments in business process redesign and investments in training and education. So these intangible assets—the organizational and human capital—are far more important, far larger than the tangible, physical investments in hardware and even software. If you look at the economy as a whole, there's about \$2 trillion worth of these computer-enabled intangible assets that are now powering the U.S. economy. This is in comparison to a couple of hundred billion dollars worth of computer hardware assets powering it.

The microprocessor and other manifestations of computer technology on the Internet get a lot of atten-

PHOTOS BY DAVE BRADLEY PHOTOGRAPHY

A photograph of Erik Brynjolfsson, a man with a beard and mustache, wearing a dark suit jacket over a light blue button-down shirt. He is sitting at a desk, resting his chin on his hand, and smiling slightly. In front of him on the desk is a book titled "Productivity" with a red cover. The background is a green chalkboard filled with various mathematical diagrams, equations, and graphs, including a coordinate plane and several matrices.

*An Interview
with
Erik
Brynjolfsson*

tion because they're visible—the “cover girls” of the revolution, if you will. But the real work that's been going on, the real impact has been through these business process changes. A big part of our agenda at the center is to understand those management and process changes so that companies can better take advantage of them. While they don't tend to be as visible as the technology, they are a lot more important.

Q: *Do you find many instances where technology is viewed as the savior, the be-all and end-all?*

A: Yes, that happens all the time, especially with CIOs and people with technology backgrounds. For that matter, a lot of CEOs think that writing the check for the technology is the end of the process. In reality, the technology is just the catalyst—albeit a critical catalyst—for a much bigger journey. So that's part of our research and what we're trying to educate companies on at the Center.

Now, it's just as important to understand that in most cases you really can't make the needed process changes unless you have the right technology in place. An equally bad mistake is to focus purely on the process side without having the technology infrastructure. The biggest payoff comes when the two reinforce one another—what I call “complementarity.” The reason that these process changes are so valuable today is that we have at our disposal a whole set of technologies that people didn't have 20 or 10 or even five years ago. And if you don't take advantage of those technologies, you're not really going to get the payoff. But you have to do both together—process and technology—not just one or the other.

Q: *You have to move forward, in parallel, on both fronts.*

A: Exactly. And that's difficult because a lot of managers today don't have both sets of skills. In fact, it's really quite rare. You've got great technologists (maybe even coming from places like MIT), and you've got people with lots of business expertise. But it's rare to find individuals with both sets of competencies. One of the goals of the MIT Sloan School of Management is to train people to have both sets of competencies. We want them to be truly comfortable with the technology but also understand the business problems these technologies are designed to solve.

Q: *Why do supply chain professionals—our readers—need to be knowledgeable about e-business technology and the e-business capabilities?*

A: To answer that, we need to first step back in time a bit. In the late 1990s, we saw a surge of interest in the Internet and then things really trailed off in 2001-2002 during the tech recession. But

what people don't understand is all through that period the capabilities of the underlying technologies continued to improve by astonishing rates—20, 30, 50 percent per year, and even 100 percent in some cases. The number of electronic transactions has been rising steadily as well. So right now we are a much more connected economy than we were at the height of 1999 or 2000. I think there was some legitimate question as to whether or not the technologies were paying off. But what the research now shows is that information technology is clearly and strongly correlated with higher productivity, higher business performance. The firms that invest more in the technology, on average, tend to do better. Whether it's Wal-Mart or Dell or any of the other companies that are changing their industries, technology is an integral part of their strategy. So it's important for your readers to understand the capabilities of e-business technologies because of the correlation to higher productivity.

Q: *The Center has conducted research identifying seven practices of a successful e-business organization (see sidebar for listing). Could you comment on a few of them?*

A: When we saw the tremendous variation in performance among the firms, we tried to understand what it was that differentiated the successful firms from the less successful ones. So we did a series of 20-minute, structured interviews with the executives at several hundred of these firms—it took quite a while—and compiled a database describing their business practices. We then looked for patterns. We found that, in fact, the companies that were very IT intensive had a very different way of organizing their work, on average, compared to the less IT intensive firms. And the ones that had adopted more of these seven practices you referred to, were substantially more productive and had higher market value than their competitors did.

Some of these factors weren't surprising. For example, the more productive companies were more likely to shift from an analog, paper-based set of systems to a digital, electronic-based set. For example, they were more likely to submit their expense reports electronically as opposed to on paper. They relied heavily on knowledge management systems, they had online directories, and so on. So that was sort of what we expected. But most of the other practices were really more on the people and organization side, not so much on the technology side. They were correlated with the use of technology, but they didn't necessarily rely on the use of technology. For instance, we found that the top-performing firms were more likely to distribute decision making more broadly throughout the organization than their competitors. They were more likely to give sales people in the field the authority to make decisions on the spot. They were more likely to have the guys on the factory floor making decisions about how the lines were running. In contrast, the more tradi-

7 Practices of Successful Digital Organizations

1. Move from analog to digital business processes.
2. Distribute decision rights.
3. Foster open information access.
4. Link incentives to performance.
5. Maintain focus and communicate goals.
6. Hire the best people.
7. Invest in human capital.

tional organizations tended to keep all those decisions more closely centralized.

And the rest of the seven practices followed a similar pattern. We're seeing an emergence of a new way of organizing work; we're calling it the "digital organization." It takes advantage of low information costs and low communication costs and really leverages people in a way that previous organizational structures didn't. Today's leading companies, the most productive companies, use the technology, but leverage it with some new business practices.

Our research agenda, and my research agenda in particular, is very much focused on making that set of practices as explicit as possible. We're documenting this not just with case studies and anecdotes but also with large-scale statistical evidence. In the study I just referred to, we looked at over 1,000 firms in the U.S. economy over a ten-year period.

Q: *Obviously a fairly robust research effort?*

A: Yes. One of the things we love to do here is look at large data sets. There's a saying at MIT that the plural of anecdote is data. Now, we love telling anecdotes as much as the next guy. But to really convince a colleague, you need a large data set that shows what you're demonstrating isn't just a fluke but something that shows up in company after company. That's exactly what we've been able to do in this research.

Q: *Based on your research and personal observations, what companies stand out in terms of their ability to create complementary processes and technology?*

A: There are a number of well-known examples like Wal-Mart, Dell, and Cisco Systems—some of which we've written about. Cisco, for example, has been a leader in measuring things quite intensely. When they roll out a new technology, they measure the results before, during, and after the rollout. Too many companies forget about the post-audits. They'll get the budget to roll out a big new system and then after the rollout, move on to the next big thing. They never go back to see whether that money they've just spent is really paying off. Cisco, GE, and a few other companies that I've talked to are actually quite fanatical about measuring. That's one of the reasons they keep improving.

CVS is another leading company. My friend over at Harvard Business School, Andrew McAfee, has been studying CVS. He's found some remarkable things in terms of their ability to improve the prescription-drug-ordering process. Part of their success relates to the use of technology. But, as happens time and time again, a bigger part of the story is about process change. Once CVS figures out how to do a process better at one location, they're able to replicate it to all 5,000 stores. So that one productivity improvement is multiplied 5,000-fold.

More and more, we're seeing the top performers replicating business processes in a way that's changing the nature of competition. If you can get a 1-2 percent improvement in the efficiency of your process, and then ramp that across all of your locations, that really turbocharges your performance.

Q: *Any other examples of best practices that come to mind?*

A: One company that stands out is Dell Computer. I was impressed with how they connected with their suppliers and how that improved performance. At one factory I visited, they recorded a 20-percent increase in output with a 40-percent reduction in the floor space. They accomplished this through some new software from i2 that allowed them to connect to their suppliers and really create an end-to-end system where the customer orders would come in electronically and then the components needed from each of their suppliers would be ordered automatically and almost instantaneously. That led to a dramatic reduction, almost a virtual elimination, of their work-in-process inventory. And this, in turn, led to a dramatic reduction in floor space. So the suppliers now deliver the components every four hours for that portion of the shift. All sorts of benefits have resulted from this over and above the immediate cost reductions. For one, they're now able to get faster feedback on production matters. So if there are any defects or problems with components, they identify the problem within a few hours as opposed to days or weeks later. That leads to a much faster cycle time and to quality improvement as well.

Q: *Those companies you cited obviously are very advanced in terms of their approach to technology and processes. For companies that are not that far along, where does the improvement process start?*

A: Well, as early as possible in the process I think the CEO has to get involved. The problem with a lot of change efforts is that you get a very bright guy who is managing the supply chain or a CIO, and they figure out a better way of doing things in their one piece of the organization. But there are so many interdependencies that if you don't have a vision that brings these components together, you actually might do more harm than good.

Q: *Could you explain?*

A: Sometimes when you shift from one way of doing business to a new way, it's like gears grinding on each other if the different pieces don't mesh well. To illustrate, let's say I wanted to turn my analog watch into a digital watch. So I take a transistor from here and an integrated circuit from there and try to bang these components into the back of my watch. It just won't work. It's not quite as bad with organizations, but the watch example underscores that you've really got to have an integrated approach. And more often than not that's going to have to come from the CEO.

Q: *Moving from the strategic vision at the top to the actual execution, what can operational people like supply chain managers do to make themselves more productive in an e-business environment?*

A: First off, you need to have an active program for cross-training yourself to understand the different

components of the business. And that means that if you have a strong technology background, you have to work on the business end of things—understand how to relate to customers, learn the company's strategic vision, understand your high-level corporate goals. Conversely, if you're great at marketing or logistics, say, then you need to think about learning more about the technology and understanding what the capabilities are. At the same time, you need to understand the technology's limitations so that you can make realistic plans in terms of taking advantage of the technology. You have to have a sense of where the benefits and the cost savings are going to come from. You need to be aware of what new capabilities are going to come on line and where things are going to take a little bit longer. Essentially, you have to find that sweet spot of combining the right new technologies with the business needs. But if you want to really make some quantum improvements in your career or your company, being able to work at the intersection of the management skills and the technology is where you'll get most leverage.

In terms of cross training, there are some concrete things readers can do. There are executive education programs, there are articles and books you can read to do it. There's just reaching out and getting to know the people, the rest of the people in the organization that have those kinds of skills that maybe could round you out.

Q: *How does the rest of the world compare to the United States in terms of technology adoption, particularly in the supply chain space?*

A: To answer that question, I first should give a little context. Ever since World War II, Europe and Asia have been working to catch up to the U.S. in productivity. Starting around 1995, the U.S. really accelerated in performance and Europe didn't, which widened the productivity gap. To give you some specific numbers, through the 1970s and the 1980s, productivity grew a little over 1 percent per year in the United States, advancing to 1.3 or 1.4 percent in the later years. Starting in 1995, productivity growth nearly doubled to about 2.4-percent growth per year. And since the year 2000, it's risen nearly 4 percent per year. We now know the biggest reason for that change has been effective use of information technology, computers, and communications technologies—the things that the Center for eBusiness is focusing on. Europe hasn't seen anywhere near those kinds of benefits. Neither has Canada or a lot of other countries for that matter. When I go over to Europe in particular, they're dying to know how the U.S. is doing it. To a large degree, it's the same thing in Asia.

Now a small part of the puzzle can be explained just by the fact that American companies are more technology intensive; they simply invest more aggressively in computers and communications technology. But there's still a lot more to it than that. The rest of the story is that U.S. firms are using the technology a lot more effectively. They have been more flexible in changing around their business processes.

In Europe there are legal, regulatory, and cultural barriers to laying people off or reorganizing. In some countries like Germany, it's hard even just to change prices in retail stores. So when you have those kinds of barriers, it makes your economy less flexible and, unfortunately, that makes it harder for businesses there to take advantage of new ways of organizing work.

The situation in Asia is similar. I'm working with Japanese companies that have done wondrous things on the factory floor. Yet if you look at their back office, if you look at their retail, their distribution, at their white collar work, they're years—maybe even decades—behind the United States on a lot of dimensions. And they are looking for ways of using technology more effectively to close that gap.

Q: *Could you talk about some of the research projects going on at the Center for eBusiness, in particular, the research being done on RFID?*

A: Brian Subirana, Rob Laubacher, and Tom Malone at the Center have been doing a lot of research on RFID. To measure the value of this technology, they're applying a model that was developed here at MIT called activity-based performance management, or ABPM. It seeks to measure the performance benefits of specific activities. There are some analogies to activity-based costing, which is an accounting approach. But measuring performance is a little trickier because performance often involves a lot more interactions among different components of the organization. The researchers have applied this methodology to some specific RFID implementations. In one project involving a big personal health-care products company, they went to their facilities and looked at the rollout of RFID at the pallet level and documented in great detail how the technology was being used. To do this, they needed a baseline of what the company was doing beforehand. One of the things they discovered, which really was remarkable to me, was the number of times an item was counted just inside the company's own facilities. When they would move finished products from one part of the factory to another, there would be somebody literally counting the items before and after. This would happen numerous times inside the factory, even before they shipped it to an external supplier.

One of the principal benefits of RFID is that it makes counting almost instantaneous. So while it might sound trivial, the capability to instantaneously count products turned out to be a very significant benefit for the company we studied. Then come the second-order effects. With immediate, accurate counts you can reduce a lot of shrinkage, you have a lot more confidence in where your inventory is, you can have faster cycle times. Well, they went ahead, and they rolled up all of the small benefits into what was the overall benefit of the system and compared it to the cost of the system. They got some very impressive ROI [return on investment] numbers.

Activity-based performance measurement is part of a broader initiative here around productivity measurement.

We're really focused on how we can not just understand the technology but really measure the performance—whether it's down at the individual component level, whether we're looking at the processes, whether we're looking at individual workers, and the tasks that they're doing, whether we're looking at whole firms and organizations, or whether we're looking at the whole economy. We've got projects at all those different levels to measure the effects of the technology and document any improvements, or, for that matter, identify the negative effects of technology investments.

Q: *Do you see RFID becoming increasingly important to businesses or is it a short-term phenomenon driven by the mandates from Wal-Mart, the Department of Defense (DoD), and others?*

A: Well, it's certainly part of a much broader trend in which all of the activities in the firm will be measured much more minutely. And cheap and abundant information—which RFID may represent—enables this.

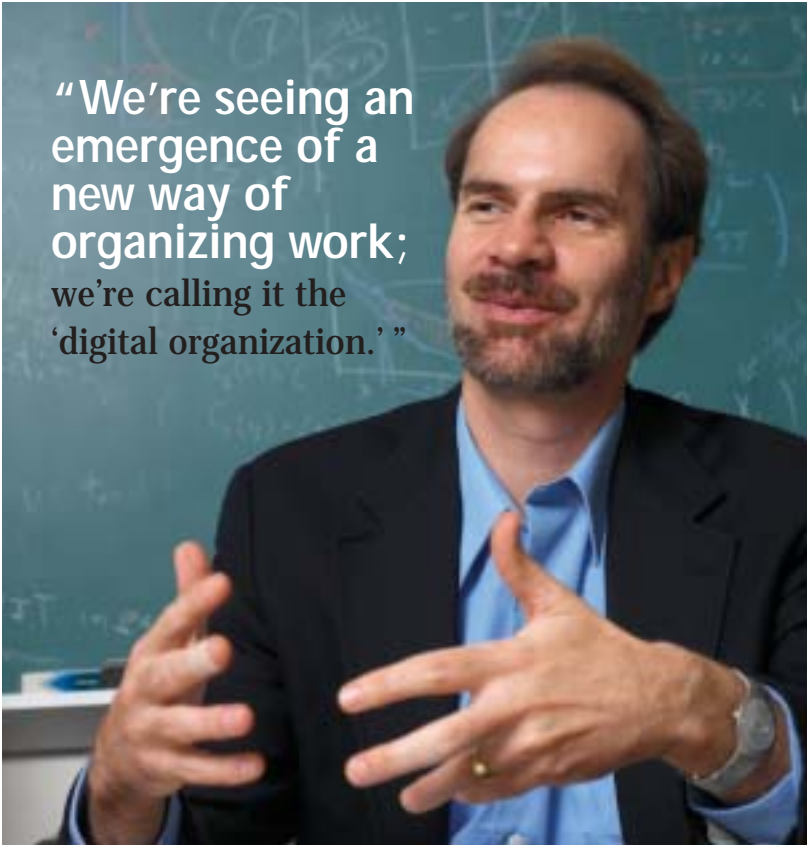
Now as for the specific RFID technologies, I think the jury is still out in a lot of ways. There certainly have been a lot of aggressive moves by Wal-Mart and the DoD and other organizations, and we've been able to document some really large performance improvements. But I think that the future of RFID probably has less to do with the technology than with the business processes and the business case to take full advantage of this technology. Managers need to think about what they could do differently now by being able to measure things more carefully through technologies like RFID. That's where the big wins are going to come—not just simply from taking their existing processes and squeezing a few costs out of the intermediate steps. And that's going to take time.

Q: *That comes back to a point you made earlier about the importance of measuring before, during, and after, right?*

A: Measurement is critical. In fact, one of the reasons that productivity is growing so much faster now than it was a couple of decades ago is not just that the technology has improved, but that we are doing a better job of measuring, monitoring, sharing, and just learning about process improvements. As information gets shared more rapidly, the whole economy tends to grow faster. A few decades ago, there wasn't as much of a culture to share, and there wasn't as much of an infrastructure for measuring and sharing the practices that were working.

Q: *e-Business enables sharing information with your supply chain partners? But is there still a hesitancy to share?*

A: Yes, that's part of the cultural problem. So now you can share a tremendous amount of information with suppli-



“We’re seeing an emergence of a new way of organizing work; we’re calling it the ‘digital organization.’”

ers and customers around the world. That information is incredibly valuable in increasing production, but it also could be seriously abused. If a supplier knows that a customer absolutely, positively has got to have this product by such and such a date or all hell will break loose, that potentially gives the supplier enormous bargaining power. And if you don't have a trusting relationship, the supplier could abuse that and hold up the customer for millions of dollars. Well, they could do that once, anyway. But when companies have these types of one-off relationships where they go with the low bidder one time and then with different low bid the next time, that does nothing to build an environment of trust in which you can share information. We're seeing a move toward not just more sharing of information, but in parallel, more long-term partnerships that are built on trust rather than low price, and “What have you done for me lately?”

Q: *So you're saying that technology is certainly an enabler and facilitator, but it has to be done with the context of trust among the parties?*

A: Well, it goes back to a word I used earlier, complementarity, which means that the change in the technology is a complement to the organizational change. Yes, you can do the technology alone, but you don't get nearly the payoff you would if you'd combined the technology with trust-oriented relationships. On the other side, trust is great, but it really gets leverage when you have the technology that allows you to share the information. The two of them together are much more valuable than either one alone. 