

Innovation in a Wired World

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Signs of an innovation revolution are emerging in leading firms all over the world. Companies such as Boeing and Motorola are applying advances in information technology and communications to „wire“ portions of their innovation and product creation processes. Chrysler, Cisco Systems, Dell Computer, and Fiat all use the Web as a new sales channel and – to their competitors’ consternation – as a source of instantaneous market data to guide product development. Others, such as Ford, General Motors, and Hewlett-Packard employ some form of computer-based development, design, or drawing. And many companies are employing online „knowledge management systems.“

These practices only scratch the surface. We are entering a world of innovation that will be radically different from the one we know today. These changes are more than merely perturbations of practices that exist today; they represent a totally new environment in which information technology and electronic communications are creating new patterns of innovation and altering nearly every aspect of business. These changes are enabled by the wiring available today. But what will innovation be like in the fully wired future? How will this transition occur? Most importantly, how do we succeed in a fully wired world?

These questions are best answered by viewing the wiring of innovation as a „media“ problem. This means that in the future, wiring will create a new immersive environment – or „medium“ – in which innovation will operate, just as fish swim in water. Treating digital media-based innovation practices as a strategic alteration of current print-based innovation practices is like asking whether water is strategic to a fish. The answer, of course, is no. Just as „fishness“ – the idea of being a fish – doesn’t exist without water, wired innovation can operate only within a digital media-enabling environment. For this reason, the most effective wired innovation practices will exist only in the world of this new medium and will almost certainly be unrecognizably different from how we innovate today.

To succeed in this new environment, business executives need to change the way they attack innovation altogether. By recognizing the enormous changes afoot, applying those changes to the day-to-day practice of innovation, and experimenting with them, leaders can give their businesses a tremendous competitive edge.

Wiring Today’s Innovation Practices

By wiring existing successful innovation practices, leading companies have already planted the seeds for tomorrow’s truly transformational wiring of innovation. As we attempt to discern what the fully wired future of innovation might look like, three elements of the prewired past and the semiwired present provide some clues:

Global Best Practices in Innovation. These practices can already be applied to almost any company anywhere; they’ve been developed and, with modification, successfully replicated by many firms in various locations and industries. For example, Asea Brown Boveri’s (ABB’s) project management system and 3M’s technology planning approach have been widely publicized, and many companies around the world are using versions of both. ABB even sells its process to other companies.

Local Best Practices in Innovation. These are effective prewiring approaches to innovation that until now have seemed suited only to certain geographical environments and business situations. Cisco, for example, has fueled its rapid growth by systematically acquiring dozens of nearby Silicon Valley technology ventures over the last several years. Thermo Electron has also grown rapidly over an even longer time span, spinning out dozens of technology-based businesses in the Boston region. The practices of both Cisco and Thermo Electron, although highly successful and widely known, have never spread to other companies or locations because they require intensive knowledge and hands-on operation.

Nonetheless, these companies and a few others like them have made technology sourcing a systematic enterprise-wide strategic weapon that totally transforms the meaning of „development.“ They have transformed innovation from a slow, largely internal and sequential process to a rich, dynamic, and super-fast growth engine that embraces a broad spectrum of technology sourcing, ownership, and value capture options. But if these and other local practices are so great, why haven’t they been adopted more broadly? The answer to this question goes to the heart of the transformational impact of digital media on innovation.

The Role of Information Technology and Communications. In the prewired and semiwired world, IT and electronic communication, when used to enhance the practice of innovation, play tactical – not transformational – roles. Practices such as electronic filing, electronic communication, and rapid computer analysis of data from real experiments are used essentially to do a better job of performing the same functions as the enabling technologies of the print-based medium they replaced – i.e., filing paper, „snail mail,“ and human computation. In the prewired world, lack of technology kept local innovation practices local.

The Transition to Fully Wired Innovation

In the fully wired world of the future, initially the impact of digital media will be to improve innovation processes and practices that already exist as part of the print-based media of the past. But beyond a certain point – and we are close to that point now – as digital media replace print-based media, they will create a new immersive environment. In that new world, truly wired innovation practices will emerge and:

- Traditional paper-based practices and processes will be discarded. Paper and printing will not go away, but digital media will replace paper as the main medium in which innovation operates.
- Global best practices in innovation will be wired and transformed.
- Local innovation best practices will vanish. Some local innovation best practices will become even less viable in the wired medium and will be discarded as a result. Others will emerge transformed to become digital media-enabled global innovation best practices.
- Totally new innovation practices, processes, and models – those with no continuous path from traditional practices – will emerge. The wiring of innovation will create unprecedented and totally new innovation practices, with no analog or connection to the prewired world. These approaches will ultimately come to dominate the fully wired innovation world that is emerging.

As wired innovation processes become more prevalent, business executives should be prepared to accept the natural demise of the barriers between local innovation practices and global innovation practices. The emergence of a fully wired enabling environment dramatically reduces the importance and value of geographic proximity. Consequently, certain successful local best practices will emerge with much broader global application in the new medium, while other local practices will disappear. As local and global innovation practices merge, companies will have new opportunities to exploit previously inaccessible or non-applicable innovation approaches.

Even a semiwired enabling environment can lead to the globalization of local innovation best practices. To date, Cisco's Silicon Valley technology „spin-in“ approach and its mirror process, and Thermo Electron's successful technology „spin-out“ approach, have existed as successful but local best practices. Now, however, as the wired enabling environment reduces the necessity for geographical proximity, we see the emergence of multimodal“ innovation practices around the world. Structurally, Xerox New Enterprises' technology spin-out approach is almost identical to Thermo Electron's, while Motorola New Enterprises has adopted important ingredients that exist in Cisco's process.

In addition to breaking down local and global innovation barriers, the emerging digital medium is redefining every dimension of business. It's already clear that the wired innovation process will be highly nonlinear – it will cut across all functions and all processes. Essentially, the entire nature of the enterprise – its people, organization, facilities, and technologies – will be different. For example, the prevalence of online development processes means that the physical facility in which a development team operates may be totally different. Tests will be conducted online, diminishing the need for large laboratories or even co-location.

Drug development provides a striking example. The traditional way to test potential pharmaceutical compounds is to rely on brilliant scientists with good intuition to select and experimentally evaluate a handful of compounds – about 100 per year – in a lab. By contrast, a fully wired pharmaceutical company may screen millions or tens of millions of potential pharmaceutical compounds per year via computer, totally altering the whole enterprise of drug development. Instead of big laboratories filled with chemists, the necessary resources will include robotics for testing, supercomputers for simulation and visualization, and people with a blend of biology, chemistry, and computer-related skills. This represents not just faster development, but a whole new strategy for exploiting technology and transformationally different processes, resources, and organization.

In addition to transforming innovation, wiring will alter every link in the business value chain. In fact, many steps along the value chain – conducted largely in a linear, sequential fashion today – will be performed in parallel in the fully wired world, creating more of a „value net“ of linked activities. Within this mesh of activities, wired innovation and development processes will be radically different because technology will enable all product development, market research/sales and marketing, and communication functions within a company to take place simultaneously (or in sequential steps so fast that they seem simultaneous), rather than sequentially. As these online processes become more prevalent, they will make companies far swifter and more efficient, enabling them to run their development processes more cost-effectively and far more aggressively.

Boeing's computer-based development system, which was first employed to develop the 777 airplane, exemplifies how an innovation process can be revolutionized by its total dependence on the new electronic medium for its design and even its existence. At the heart of the system is an online electronic prototype on which Boeing's R&D organization, manufacturing unit, suppliers, and customers can operate at once. The result is a greatly accelerated, highly parallel development process that uses no physical mockups or paper drawings.

Designing a new plane model used to take anywhere from three to five years. By conducting development, market research, and vendor/supply chain preparation simultaneously, Boeing has dramatically shortened its development cycle for the 777 to 18 months.

For some companies, wiring the product development process has been the consequence of wiring other functions. Dell Computer's online direct sales model represents an excellent example of a company that set out to make some changes in its sales model, but in doing so, perhaps somewhat inadvertently, created even more dramatic changes than it originally planned. Using the Web as a sales medium allows Dell not only to profitably sell PCs for less, but also to realize product development improvements and supply chain efficiencies by adjusting its future product offerings and component orders on the basis of accurate, instantaneous, real-time customer information. Dell gathers this information about preferences and demand both by mining the „clickstream“ (looking at which icons viewers „clicked“ on to track their interest in certain products) and by tracking consumers' actual buying behavior as they shop for computers on the Web.

This puts Dell's competitors at a huge disadvantage. These competitors pay an 8-10 percent distribution premium over the cost of direct sales for their value-added reseller channel, an enormous cost disadvantage in the hotly competitive, low-margin PC business. Lacking Dell's accurate and instantaneous customer information, they incur major inventory carrying charges and are more likely to have unsold inventory. For example, Dell recently reported carrying 11 days' worth of inventory, while a typical value-added reseller channel competitor carries 80 days' worth – more than 7 times as much. Dell also uses its instantaneous and accurate customer purchase data to guide intensive multi-year planning with key vendors, driving product development and cost-cutting at those key suppliers.

The Future of Fully Wired Innovation

Because fully wired innovation practices will be so transformational, they are difficult to envision today. And while there is no way to prove that these forms of innovation will occur, a close examination of the changing medium, combined with some historical examples of leapfrog technologies, makes a powerful case that dramatic change will take place. To that end, we can anticipate at least four categories of new wired innovation practices.

Subprocess Wiring. This is the acceleration, improvement, extension, and transformation of an innovation sub-process such as ideation, concept development, or product design. Motorola's substitution of computer simulation for experimental design and testing of its cellular phones is a good example of subprocess wiring. Initially, such a simulation-based design and testing process serves as an improved direct substitution for physical testing. In conducting computer-simulated testing of its phones, for example, Motorola uses computers and videos to provide very fast, low-cost „X-ray“ visualization of the mechanical, thermal, and electrical behavior of a Motorola phone when dropped. These insights are simply not obtainable from conventional physical testing. Taking that approach one step further, Motorola has found that simulated design and testing transforms not only the design/test step, but the entire development process. The high-speed, low-cost, and digital nature of simulated testing means that many more tests can be conducted within a given budget and timeframe. Furthermore, these tests, previously sequential, can be rapidly integrated and iterated with other portions of the innovation process, such as technology development or market research. Thus we see that subprocess wiring can be a powerful innovation weapon by itself and can create many more far-reaching benefits.

Incremental Process Wiring. This is the evolutionary wiring of the support infrastructure to enhance and improve, but not fundamentally alter, an existing innovation process. For example, remote users find ABB's online „Pipeline“ product development/project management system much faster and more inviting than traditional systems. This has helped ABB to globalize R&D, operating eight major laboratories on three continents, and better compete against swift and powerful companies such as GE. Pipeline is an „incremental“ improvement because it performs the same job as the paper system that preceded it – and the company can temporarily patch a breakdown in a segment of the wired system by using the old paper-based approach. Pipeline is a critical milestone in the wiring of innovation at ABB and a potent competitive weapon. By making global innovation possible – and hence mandatory – for competitive success, Pipeline „raises the bar“ for everyone, setting the stage for more revolutionary wired innovation practices.

Similarly, Avery Dennison's online global technology visioning and planning process largely follows the structure of the paper-based process it replaces. The company improves on the old process by enabling people from around the world to participate as peers, making global teaming and strategic planning almost routine. The new process is much faster than the old – strategic planning now takes three days instead of two weeks. Wiring also brings subtle but transformational improvements to the process, such as truly anonymous multivoting and brainstorming approaches that encourage quiet people to participate, undeterred by aggressive colleagues. By encouraging input from more employees, Avery Dennison is able to generate and capture more ideas. A two-hour meeting can yield 100 possible solutions compared with only 5 solutions traditionally generated in a full-day meeting of a select few.

True Discontinuous Process Wiring. This is process-wide acceleration, enhancement, and discontinuous improvement. In designing the 777, Boeing transformed its innovation process into a highly parallel, seamless process involving multiple partners, and organized around an electronic prototype that could not, even in principle, be operated outside the new wired environment. Dell's online direct sales model portends equally revolutionary changes for innovation.

Discontinuous Super-Process Wiring. In addition to the transformation of individual innovation processes such as those previously mentioned, the emergence of a fully wired enabling environment totally alters the relationships among innovation processes, with dramatic implications for the practice of innovation. One of the most important effects of innovation super-process wiring is that the practice of innovation collapses from a set of largely separate and sequential processes into a tightly linked mesh of cross-functional, co-evolving processes. For example, Netscape and some other software vendors employ extremely rapid „co-evolving“ product development and sales processes that exploit the speed of online beta testing with lead customers. Some software firms have been using this approach for some time, but the accelerated online process is creating unbelievably short cycle times and expanding to many other types of businesses, as Dell Computer's experience illustrates.

Preparing Your Company for Success in a Fully Wired World

Four key approaches can help business executives find their way to the future wired world of innovation:

View the future as a new, immersive medium. Critical to success in the fully wired world is a business executive's view of what lies ahead. Treating IT and electronic communication as a wholly new immersive environment in which the practice of innovation will operate is perhaps the most important approach to preparing for this future. Think of your company as fully immersed in the wired world, as you would visualize a fish in water.

Experiment. For business executives, the next step toward success in tomorrow's fully wired world is to recognize and accept several key truths about today's semiwired world: Today's business environment is filled with turbulence. Most of the impacts of digital media on innovation are still unknown. The unpredictability of these outcomes makes the ability to rapidly conduct many „experiments“ paramount to success. Conducting pilot experiments with specific processes is a good place to start. The key is to resist the impulse to wait for clarity. Standing still is not beneficial in a dynamic and turbulent world.

Study and learn from historical analogs. Exploring and learning from past media transformations and what they've meant to innovation and other aspects of society in their time will help to prepare you for the changes ahead. The shift to movable-type printing 500 years ago is a good analog to illustrate just how transformational the impact of new media can be. The new applications customized to the new medium – newspapers, periodicals, and novels, which even today are the „killer apps“ of print-based media – did not exist before movable type was invented.

Examine the innovation constraints that the new medium removes. Which constraints will the new wired medium remove? What assumptions of the prewired world no longer apply? What new degrees of freedom exist for the practice of innovation? If the new electronic medium relaxes constraints related to communication, computation, and information storage to a great degree, we can naturally expect to see dramatically different innovation practices in the future.

We are poised to enter a new world of innovation that will be almost unrecognizably different from the way we practice innovation today. The cause of this change is the wiring of innovation practices on a grand scale, as digital media creates a new immersive environment in which the practice of innovation will operate as naturally as fish swimming in water. As a result, totally new innovation practices, processes, and models – not based on traditional practices – will emerge. Recognizing this transformation and „getting in the swim“ through exploration and experimentation will be key to future success.

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