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Sparking Growth and Renewal Through New Products

The Impact of Information Technology

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All over the world, companies increasingly depend on new products and services to spark profit growth and renewal of their assets. In our research program at the University of Texas, we focus on developing rigorous frameworks and relevant methods for the effective and efficient commercialization of technologies and for the creation of compelling new product and service offerings. Our research, published in top academic journals, has largely been driven by real applications in a range of Texas companies, including Dell Computer Corporation, National Instruments (NI), and DTM Corporation. One of the challenges facing executives at these companies is how to apply information technology and the Internet to raise the productivity and increase the return on investment from their product development projects.

In addition to challenges, the rise of the Internet has also created new opportunities for company executives. On the one hand, the Internet can provide critical information to product development teams on a timely basis and allow for closer involvement of customers and suppliers throughout the development process. On the other hand, it has increased the speed at which products can be released and has enabled buyers to become more educated, better informed, and, at times, more activist customers.

Many believe the connected digital environment to be a revolutionary development. The Internet's effect on new product development at this stage, however, remains largely *evolutionary*. Companies are gradually incorporating the Internet in their development projects by digitizing documents, data, and work flows. The global connectivity unleashed by the Internet also means that firms can use high bandwidth communication systems not only among their in-house developers, but also with suppliers, customers, and other complementary companies. Beyond this, however, Texas companies such as Dell and NI have used Internet technologies to transform business processes, resorting to what some observers call *collaborative product commerce* by increasing their outsourcing and working closely with suppliers, thereby extending their enterprises. In the past, companies developing products for the consumer market (so-called "B2C" companies) typically involved customers at the beginning of the process and again at the end for prototype testing. Now, the Internet allows companies to bring their customers much closer to the development process in its entirety and transform them from passive participants to active "co-developers" of a product. For companies that buy and sell with each other ("B2B" companies, such as NI), the Internet makes it possible for them to integrate their development process seamlessly with that of their customers, creating an extended enterprise.

Indeed, the networked digital environment has significantly affected some companies' offerings—and not just those firms whose offerings consist of a major information component. Consider the case of one company, which sells blank storage media

The Internet affects product development at five levels:

- Basic digitization of data and work flows
- Global connectivity with developers, customers, and suppliers, resulting in 24-hour development possibilities
- Internal infrastructure changes in product development process, models, and decision support systems
- A reexamination of the entire system and life cycle of a product
- An increase in outsourcing and an extension of the enterprise

such as floppy disks and blank CD-ROM disks. Initially, this firm viewed e-commerce as primarily an attempt to use the Web to drive sales of its diskettes. A more subtle implication, however, became apparent: the emergence of the broadband Internet meant that customers can increasingly store their files on central servers. Firms that view the connected digital environment narrowly, such as the one mentioned above, do not see the true implications of the Internet.

Outsourcing and the Internet

In the past, outsourcing product development, proved a difficult proposition. It took time to talk to suppliers, and they were not always reliable. Now, however, with the connectivity offered by the Internet, lower transaction costs make it easier to access a talented global supply base. Video conferencing, real-time file sharing, and global telecommunications have significantly improved both the quality and quantity of the suppliers available to a company. What's more, out-sourcing can be attractive to companies because margins are falling as a result of intensifying global competition. Without comfortable margins, companies find it increasingly difficult to justify so much in-house development. They must depend on suppliers who pool an entire industry's development, thereby allowing firms to focus on narrow areas where they can differentiate their products. However, opportunistic behavior by suppliers does not vanish with the Internet; there are perils associated with outsourcing research and development. Firms must recognize and internalize the risks of outsourcing in their make-buy decision making.

Support Infrastructure

The methods, processes, metrics, and systems that companies use to support new product development efforts is considered "infrastructure" in the new product development stream. In the past, the expectation for a start-up company was to begin with one product and then gradually roll out more products as the firm developed product lines and portfolios, comfortably managing economies of scale. In this new era, companies grow rapidly, but they also expect to possess a portfolio of products much earlier in their life cycle. As a result, some of these companies rush to build an infrastructure that allows them to develop a whole product portfolio and "scale" much more quickly.

Larger companies, on the other hand, have always had this kind of infrastructure, but over time, this infrastructure actually has rendered such companies too rigid. Large established firms often approach the development and launch of products in a very structured manner. Product specifications are firmly established early in the development process. However, now that markets are changing and new technologies are emerging, large companies, if they commit too early, can get locked into a product cycle possibly at odds with rapidly developing consumer or market demands. Such established companies need to make their infrastructure more flexible. Take as an example an automotive company that introduces a minivan with three doors. Market conditions change and customers now demand four doors. If the company only tries to make the third door bigger because its product development process is too rigid to make a quick change, their minivans will not satisfy customers. Because the company is not flexible enough, it must wait for the next revision of the product to introduce a fourth door in its minivan.

A Balancing Act

Delivering products to market on time requires discipline, but too much discipline can constrain the flexibility that companies must maintain during the development process. For example, managers are evaluated according to how closely they adhere to budgets, but this means of measurement prevents them from adapting quickly to changes in market conditions or to the emergence of new technologies. What is really needed is "structured flexibility," that is, a merging of *structure* for the timely delivery of products to market and *flexibility* to ensure that these

products are attractive and in tune with customer preferences. Some industries, such as machine tools, chemicals, and pharmaceuticals, require more structure in their product development process. Others, such as electronics and even automotives, call for more flexibility to respond to changes in technology and consumer taste.

The Future

How will the product development process change in the future? The short term promises more outsourcing and more companies buying from suppliers and integrating them more closely into development processes. In addition, enterprise systems that incorporate manufacturing supply-chain processes will proliferate. In the longer term, at least in some product categories, we may see some more far-reaching changes. The manufacturing sector may undergo the "Hollywood" phenomenon. This term refers to the filmmaking process wherein teams form dynamically for every movie project and then disband after the film is completed. A similar phenomenon may affect many product categories in the future as experts come together and then disband upon completion of a project. However, appropriate technology, a modular system architecture, and solid project leadership will be essential if such a system is to succeed.

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Two Examples from Texas

Contrasting illustrations of product development success stories can be found in the experience two Texas firms, National Instruments and Dell Computer Corporation. National Instruments, based in Austin, has made huge strides in product development productivity. NI developed an innovative business model of software-based instrumentation that dramatically reduced costs for its customers. It has followed up its business model with a stream of data acquisition and instrumentation products that are based on well planned product platforms. Through the use of these core platforms, NI has achieved great returns on its investments in research and development.

Dell Computer, on the other hand, operates in a market where products are fast becoming a commodity. Dell cannot afford to spend much more that 2 percent of revenues on product development, but it needs differentiated products that support its direct-to-customer business model. The company started with digitization, converting papers and documents into digital information so time could be spent processing, rather than tracking down, data. In some ways, this recalls manufacturing before Henry Ford at the beginning of the twentieth century when manufacturers spent most of their time looking for, instead of assembling, parts. Today, Dell is developing a system called E-PRP (electronic product realization process), a private Internet network within the company that provides engineers and other developers with real-time access to whatever information they need, eliminating many local databases and centralizing the workflow. The next stage for Dell will be a harder look at the products and services the company offers. Expansion into services and higher margin-yielding storage and server products is a priority.

Where to Start?

Where should a company begin when incorporating the Internet into its product development process? The key words are: think big, act small, start now. First, there should be "low-hanging fruit" in the areas of digitizing documents and data and automating work flows. A company can deploy this connectivity to create higher bandwidth communication links—both internally and among the company, its suppliers, and its customers—to achieve immediate returns on investment. Then a company should examine its product architecture and the infrastructure in which products are created and developed. Are there carefully crafted product and system platforms that can be reused to develop new products? Does the product development process allow the company enough flexibility to respond to the dynamics of the market, incorporate the latest technology, and deliver innovative solutions to the

customer? Perhaps the company can locate suppliers who can more efficiently produce what is currently developed in-house?

It should be noted, however that outsourcing is not for everyone. It may lead to the hollowing out of a company's core competence and might compromise a company's competitive advantage by lowering barriers to entry. Also, the coupling between the product and the development and manufacturing processes can be very strong, which means outsourcing a particular product or system may be difficult. As a result, managers should limit themselves to outsourcing only those products that are becoming commodities, that are not part of a firm's core competency, or that involve little cost of interaction with suppliers.

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Cost and Persuasion: Selling Management on the Internet's Efficacy

For most companies, investing in Internet technologies should generate long-term results in reduced development time and greater productivity. Also, a company can phase in Internet investments gradually and calculate the payoffs before further investments, an approach product development companies are very used to as they incur development expenses. A company should not wait to run elaborate return-on-investment (ROI) calculations, although a discussion of the benefits and back-of-the-envelope calculations would not be a bad idea. Reducing product cycle times does not, however, ensure a better product—quality improvement, better performance, and greater customer satisfaction are still very much dependent on the expertise, problem-solving capacity, and creativity of a company's human resources. Nevertheless, improving development productivity and ROI presents a very big opportunity for many companies that are contemplating the Internet in their new product development and launch efforts.u

Integrating the Internet into Your Business: A Brief Primer

Integrating the Internet:

· Go after the "low hanging fruit" by digitizing document, data, and work flows.
· Connect internal and external stakeholders.
· Look at the product architecture and plan a move to a more modular approach.
· Examine the infrastructure.
· Consider outsourcing.
· Review the product and system platforms.

When selling the use of the Internet to management, consider the following:

· Investments can be phased in more gradually, especially with a modular architecture.
· The Internet can provide the ability to quickly scale from one or a few products to many offerings.
· Much of the investment is upfront with the first product; the benefits are realized with subsequent products.
· Benefits can be the reduction in cycle time, a better product more in tune with customer needs, and improved communication and work flows.

Trends in U.S. Productivity, Annual Rates of Change, 1988-1998

(percentage)

Output per Hour in Selected Industries

Industry	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
computer & office equipment	21.4	2.3	11.2	8.3	30.9	32.1	27.1	42.9	45.1	37.5	43.6
electronic components & accessories	9.0	9.8	11.4	16.0	22.3	15.1	25.8	46.5	28.2	18.6	25.2
metalworking machinery	1.0	2.6	-2.3	-4.6	8.2	2.9	2.3	4.5	0.1	3.2	1.4
special industry machinery	4.6	3.5	-0.7	0.7	-2.1	7.2	6.7	9.1	1.3	-2.9	-3.2
communications equipment	10.5	-3.1	13.2	2.6	17.8	2.5	10.5	2.9	11.4	16.1	3.4

Output per Employee in Selected Industries

Industry	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
computer & office equipment	20.5	2.7	11.0	7.9	31.4	32.1	28.0	43.2	44.2	37.7	43.2
electronic components & accessories	8.6	9.4	11.4	16.0	23.6	15.7	26.5	46.1	27.2	20.8	23.7
metalworking machinery	2.7	2.6	-3.9	-5.6	9.6	4.2	3.8	4.0	-0.7	4.4	-0.4
special industry machinery	4.6	3.5	-1.1	0.1	-1.6	8.4	8.2	8.5	0.2	-2.0	-4.7
communications equipment	10.5	-2.2	13.9	1.0	18.8	4.0	9.9	3.0	11.2	15.8	3.2

Unit Labor Cost in Selected Industries

Industry	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
computer & office equipment	-8.8	-6.1	-10.5	-2.4	-20.4	-19.7	-20.8	-27.3	-26.7	-25.3	-29.2
electronic components & accessories	-4.0	-2.3	-3.9	-6.4	-10.5	-9.8	-19.4	-30.1	-24.2	-14.5	-18.5
metalworking machinery	-1.7	1.0	7.8	7.3	1.7	-2.1	-5.1	1.0	4.7	1.2	1.8
special industry machinery	-1.8	1.0	6.3	5.2	4.9	-2.7	-3.0	-5.9	-1.7	1.3	9.9
communications equipment	0.8	9.4	-8.2	2.2	-5.8	-4.2	-7.2	-5.7	0.2	-2.8	-2.2

Source: U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, data from Industry Productivity database (http://www.bls.gov/).

Productivity describes the relationship between output and the labor time involved in its production. It reflects the joint effects of many influences, including changes in technology, capital investment, and managerial skill, among others. *Unit labor cost* describes the cost of labor input required to produce one unit of output.

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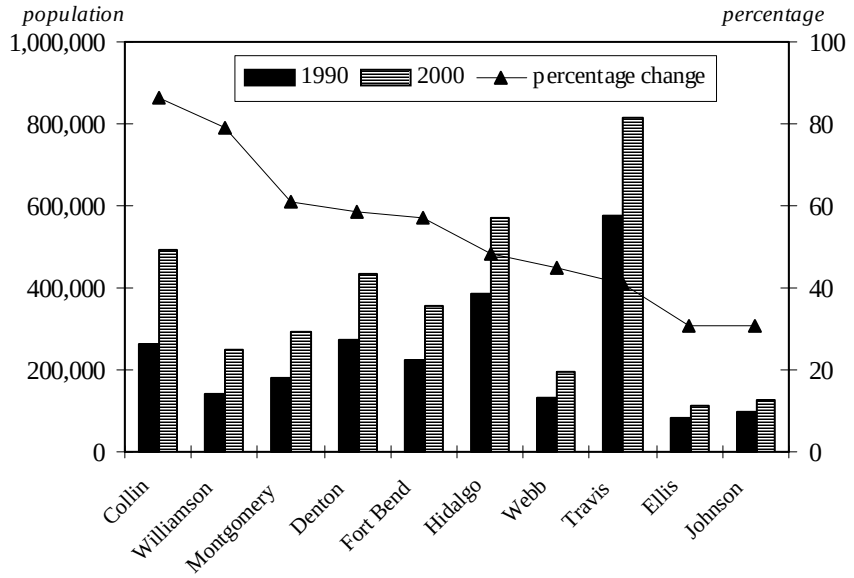

Source: U.S. Department of Commerce, Bureau of Census, 2000 Census of Population, March 2001, and 1990 Census of Population, 1992.

Announcement

The 2000 Census Data are now available from the Bureau of Business Research. Visit the BBR website (www.utexas.edu/depts/bbr) for the recently released data. We have city- and county-level data that are not currently available from the U.S. Bureau of the Census. Please contact Rita Wright, the BBR's Professional Librarian, at 888-212-4386, or e-mail her at rjwright@mail.utexas.edu.