Information technology and business-process redesign

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Abstract *Business-process redesigns (BPR) and information technology (IT) are natural partners, yet this relationship has not been fully exploited. Those organizations that have used IT to reengineer processes have benefited enormously. This article argues that those aspiring to do business process redesign must begin to apply the capabilities of information technology. Process redesign is not always successful and almost always accompanied by pain or at least unpleasant side effects. Many companies have undertaken reengineering efforts only to abandon them with little or no positive result. How can you increase the odds for success? Here are a few lessons from the front.*

Introduction

Every decade or so, corporate America discovers an approach for managing organizational change, and the 1990s were no exception. The leading performance improvement approach of the 1990s was business process redesign (BPR) or business process reengineering. The term "reengineering" first appeared in the information technology (IT) field and then has evolved from its initial IT orientation into a broader change process. The aim of this radical improvement approach is quick and substantial gains in organizational performance by starting from scratch in designing the core business process. As we entered the 1990s, organizations found it necessary to develop more flexible, coordinative, team-based, and communication-based work capability. Many US companies have embraced reengineering as the most effective tool to redesign their core processes and implement changes to make the organization more efficient and competitive. The motivation for reengineering was usually the realization that there was a need to speed up the process, reduce needed resources, improve productivity and efficiency, and improves competitiveness (Hammer and Stanton, 1995; Verespej, 1995; Wellins and Murphy, 1995).

BPR is going through its second wave. BPR is gaining importance as organizations develop inter-organizational relationships, alliances, and other methods of cross company coordination. These relationships require some reengineering to facilitate processing across the boundaries of the two organizations. (Nissen, 1998; Broadbent *et al.*, 1999). Hammer and Champy (2001) reinvigorate the topic for the new millennium in their clear revision of their famous book, *Reengineering the Corporation*. This book once again brings process improvement to the forefront of business-management consciousness.

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They reintroduce the goal of making major gains in reducing "waste" in the organization. They suggest that we all get busy reexamining every single process and rebuilding US business from the ground up (Hammer and Champy, 2001).

Another reason for popularity of BPR relates to the increasing emphasis being placed on integrating business Web sites with backend legacy and enterprise systems, as well as organizational databases. Such integration may require substantial reengineering (Kalakota and Robinson, 1999). In his new book, management guru, James Champy argues that BPR was 1990s remedy for sluggish corporations that lacked customer focus and competitive ability. Today, he sees the reengineering of the last decade as only a beginning. Reengineering was just the first step. In this decade, businesses will need to continue the effort by using technology to add customers, suppliers, and other partners to the process redesign mix. The redesign of work will be not just within the walls of a company, but between a company and its customers, suppliers and partners. He calls this process X-engineering. The "X" denotes the crossing of organizational boundaries. As with reengineering, he believes companies have no choice but to X-engineer. Companies such as Cisco, Dell, Intel and Solectron are case examples of successful X-engineering implementations (Champy, 2002).

As we entered the 1990s, however, another set of tools transformed organizations to the degree that Taylorism once did. This was information technology – the capabilities offered by hardware, software applications, and telecommunications. Significant shift from mainframe technology to open systems based on PC increased the "democratization" of IT. Significant reduction in the cost of IT resulted in enormous investments in IT applications that have stimulated increasingly complex organizational change. Information technology has been used in most cases to break down communication barriers between corporate functions, to empower line workers and to fuel process reengineering. In most cases, IT has been used to expedite office work rather than to transform it. Top executives consider IT as a potent source of competitive advantage.

Working together, BPR and IT have the potential to create more flexible, team-oriented, coordinative, and communication-based work capability. This paper suggests that IT can be more than a useful tool in BPR. Information technology is more than collection of tools for automating or mechanizing processes. It can fundamentally reshape the way business is done and enable the process design. In leading edge practices, information technology makes BPR possible and makes it worthwhile. For organizational change to be effective, IT, business process, and organization need to be adapted to each other. BPR and IT are natural partners, yet their relationships have not been fully explored. Given the growing dominance of services, the recursive relationship between IT capabilities and BPR is in need of further analysis and

redesign. How can IT help the organizations in achieving the flexible organization structure? How can IT support the core competencies of the organization? How can IT help the organizations in coping with an increasingly complex and uncertain environment? How can IT facilitate alliances and other methods of cross company coordination?

This article explores the relationship between IT and BPR and provides a summary of IT roles in initiating and sustaining BPR. Furthermore, it examines several companies that have applied IT to reengineering and have reported successful implementation and experienced increased productivity, quality improvements, and reduced inventories.

IT capabilities and reengineering

Information technology is defined as capabilities offered to organizations by computers, software applications, and telecommunications to deliver data, information, and knowledge to individuals and processes. For long, industrial engineers have used IT in manufacturing as an analytical and modeling tools. Common uses of IT in manufacturing include production scheduling and control, process modeling, materials management information systems, and logistics.

IT has penetrated the office and services environment since the 1980s. The shift from mainframe to PC based technology is breaking down communication barriers between employees and customers. Now managers and employees from various departments are designing and controlling complex business information systems. Formerly managed by centralized MIS departments.

IT's capabilities involve improving information access and coordination across organizational units. IT is so powerful a tool that it can actually create new process design options, rather than simply support it. In his new book, *Business @ the Speed of Thought*, Bill Gates (1999) argues that if the 1980s were about quality and the 1990s were about reengineering, then the 2000s will be about velocity. He analyzes absolutely all the consequences of the release of IT in the Internet time onto the economy, society, administration, and life. He shows how IT will alter the lifestyle of consumers and their expectations of business. Only managers who master the IT process and the digital universe will gain competitive advantage. Gates advocates complete digitalization of all aspects of life. He argues that to be successful in the digital age, companies need to develop a new digital infrastructure similar to the human nervous system. This new digital system enables companies to run smoothly and efficiently, makes them respond quickly to emergencies and opportunities, provides a mean for quickly getting valuable information to the people in the company who need it. This in turn empowers employees to quickly make decisions and interact with customers (Gates, 1999).

Implementing reengineering is not a free-form exercise. There are specific steps to be performed in a particular order for the reengineering efforts to be

successful. IT can be more than a useful tool in business process redesign; it can make BPR possible. Its role can be categorized into three phases: before the process is designed, while the process design is underway, and after the design is complete. Table I provides a summary of IT roles in initiating and sustaining BPR.

Phase 1. Before the process is designed (as an enabler)

It is difficult to assess how much scope there is for radical process change in today's business world. However, opportunities exist for improving existing business process as well as identifying and defining new business processes for radical change. BPR is a strategic action and requires a clear understanding of customers, market, industry and competitive directions. Furthermore, like any other strategic action, it requires consistency between the company's business strategy and vision. Defining business strategy and developing strategic vision require understanding the company's strengths and weaknesses, and the market structure and opportunities.

This phase determines if there is truly potential for reengineering or if other improvement models such as total quality management may be appropriate. The activities in this phase may include:

- developing a strategic vision;
- identifying the customer's objectives;
- establishing goals/targets related to market share, costs, revenue enhancement, or profit margins;
- assessing the potential for reengineering;
- defining boundaries and scope of the appropriate process; and
- keeping management committed.

IT capabilities can provide good insight into the existing conditions. IT is one of several enablers in BPR efforts, including human resources and organizational change, that all must be considered together to bring about change in business processes. These enablers need to be identified early in the reengineering process so that the design process includes their capabilities from the start.

Many companies ignore IT capabilities until after a process is designed. An awareness of IT capabilities can and should influence process design, not just complement or support the process. Michael Hammer warns companies not to make the mistake of "automating cow paths". He recommends companies to redefine the process first and automate it second (Hammer and Champy, 1993).

IT can play important roles in this phase of BPR efforts as follows:

- The opportunity IT provides is to utilize newer and better technology to develop a strategic vision and to help improve the business process before it is designed. For example, an important Wal-Mart vision was to

Table I.
IT roles in initiating and sustaining reengineering

Before the process design	During the process design	During the implementation
Create infrastructures and manage information that support evolving organization	Bring vast amounts of information into the process	Create a digital feedback loop
Foster process thinking in organizations	Bring complex analytical methods to bear on the process	Establish resources for critical evaluation of the reengineered process
Identify and select process for redesign	Enhance employees' ability to make more informed decisions with less reliance on formal vertical information flows	Improve IT processes to meet increasing needs of those divisions that have gone under reengineering processes
Participate in predicting the nature of change and anticipate the information needs to support that change	Identify enablers for process design	Institute a program of "cleanup" and damage control in case of failure
Educate IT staff in non-technical issues such as marketing, customer relationships, etc.	Capture the nature of proposed change and match IT strategy to that change	Communicate ongoing results of the BPR effort
Participate in designing measures of success/failures of reengineering	Capture and disseminate knowledge and expertise to improve the process	Help to build commitment to BPR
	Communicate ongoing results of the BPR effort	Evaluate the potential investment and return of reengineering efforts
	Transform unstructured processes into routinized transactions	
	Reduce/replace labor in a process	
	Measure performance of current process	
	Define clear performance goals and objectives to drive the implementation	
	Facilitate alliances and other means of cross company coordination	
	Define the boundaries and scope of the process	

eliminate unnecessary distribution steps and cost and to provide value to customers. To accomplish this, Wal-Mart developed a strategy that includes linking its suppliers to its retail stores. IT, eventually enabled Wal-Mart to implement this strategy. An enterprise-wide information system was developed that directly connects all retail locations, distribution warehouses, and major supplies (Furey and Diorio, 1994). Del Computer sells PCs directly to customers. The company wanted to automate its procurement process to streamline the entire process, to tighten control, and to enforce optimized purchasing strategies. The Web technology, eventually enabled Del Computer to implement this strategy. The company leverages the Internet technology in dealing with both customers and suppliers. The PC maker is encouraging customers to adopt Web-based procurement systems that can hook directly into Dell's order management system. Litton Industries used the option to order PCs from Dell. The change cut the average time to submit an order from 21 days to less than two, and provided a saving of $200,000 for Litton (*BusinessWeek Online*, 2001).

- The capabilities of IT to track information and break down geographic and organizational barriers are useful in understanding the company's strengths and weaknesses, and market structure and opportunities. IT applications would allow organizations to increase the amount and effectiveness of collaboration in ways that was not possible before. The Internet can improve internal communication among different departments, work groups, branches and individuals. External communication – contact to customers, vendors, suppliers, government agencies and even competitors, can also be greatly improved by the Net. Communication technology helps to overcome geographic barriers and thus enable broader acceptance of the process change. Shared databases and freedom to communicate more widely with e-mail are enhancing employees' ability to make more informed decisions. At General Electric e-mail systems are used to speed analysis and design sharing and to hold frequent virtual meetings between group from different regions and overseas.
- The focus of this stage is on finding radically different approaches to manage a process. These approaches can be found and be adapted from practices of companies outside of the industry. The organization should benchmark against other industries and combine it with the experience and expertise of the team members to adopt an entirely new process technology. IT capabilities such as collaborative computing technologies can be used in introducing the organization to the creative practices of other organizations.
- BPR requires a flexible organization design. The existing rigid infrastructure of the organization must be altered to facilitate

cooperation between various departments by using cross-functional teams instead of individuals working in isolated departments. IT capabilities could be used to create flexible infrastructures that support evolving organizations. Flexible infrastructures are the ones that adapt to changing external drivers. Therefore, the flexible infrastructure include processes for continuously evaluating existing tools to see what should be removed, and continuously seeking user input about what works and what does not.

- Central to success of business process redesign is to make teams the focus of organization performance and design. To achieve effective teamwork, each worker should develop several competencies. The IT organization is no exception. The demand for close collaboration with other functions dictates the need for IT staff to broaden their portfolio of skills especially in non-technical issues such as marketing, customer relationships, etc. The combination of the Internet and the Intranet services allows a collaborative team effort from around the globe. This has given birth to a new way of doing business – the "virtual organization".
- Alliances and other methods of cross company coordination are becoming common-place in the current business environment. In an attempt to gain market shares, many firms are teaming and collaborating with suppliers and distributors. These cross-functional efforts enable firms to streamline their processes to maximize efficiency. Information technology facilitates the prolific forming of cooperative efforts by enabling organizations to create linkage between suppliers, distributors and customers. In 1998, the Voluntary Inter-industry Commerce Standards Association (VICS) set up a committee to identify the best practices and design guidelines for collaborative supply chain forecasting and planning (Collaborative Planning, Forecasting, and Replenishment VICS Subcommittee, 1997). Participating in the project were leading retailers, consumer packaged goods manufacturers as well as consulting and software providers. The collaborative planning, forecasting, and replenishment (CPFR) process model represents voluntary guidelines aimed at structuring and guiding supply chain partners in setting up their relationship and processes. With VICS' involvement and support, more companies were willing to participate in the validation and testing of CPFR. According to a new survey of manufacturers, retailers, distributors, and logistics providers conducted in 2000, CPFR was the third most widely used initiative. Given how new CPFR is, this is a very impressive statistic. CPFR is not considered a technical standard. It is rather an initiative that facilitates the reengineering of the replenishment between trading partners. An important promise of CPFR is that accuracy of the forecast (demand, order, sales) can improve by having the customer and supplier participate in the forecast. If a discrepancy occurs, the trading partners can get

together and decide on the replenishment quantity to rectify the problem. This type of collaboration offers a great potential to drastically improve supply chain performance through collaborative demand planning, synchronized production scheduling, logistics planning, and new product development.

Phase 2. While the process is being designed (as a facilitator)

This stage is about moving the reengineering efforts from concept to detailed design and involves two activities: technical design and social design. During the technical phase, information is consolidated, alternatives are redefined, process linkages are reexamined, and controls are relocated prior to applying technology. The second phase, the social design, focuses on the human aspects and involves employees who will affect corporate changes. Issues such as defining jobs and teams, defining skills and staffing needs, and designing incentives are considered carefully. In this stage, employees who are most affected by the change should be encouraged to build cross-functional teams to participate in the process of analysis and the restructuring of the operations. These teams should be instructed to look for ways to eliminate unnecessary steps, and to increase the quality and speed of steps in the process.

This stage is also about developing test and rollout plans. After the objectives are identified, the existing processes are mapped, measured, analyzed, and benchmarked, these efforts are combined to develop a new business process. In this stage, development of people, processes, and technology are integrated. Reengineering teams define projects' scope, select methodologies to be employed, develop pilot test strategies, and set performance standards for the project teams.

During the process design, accountability for development, testing and implementation must be clearly defined. Furthermore, a change control process and a communication plan must be put in place. IT capabilities can be used to keep the reengineering solutions consistent with the vision, the fiscal constraints and anticipated benefits. The other important role IT plays in the BPR is that of facilitator. Real benefits to the business result when IT becomes involved with more fundamental changes to the business process itself. Michael Hammer notes "Information systems (IS) can not play a leadership role. But there is a very important role, an active role, that IS sometimes plays, what I call the catalytic role" (Hammer and Champy, 1993). IT's role is to get it done when strategic decisions demand a response.

The crucial roles that IT plays in this phase of BPR efforts are:

- IT can facilitate the reengineering design process through the use of project management tools. These tools help identify, structure, and estimate BPR activities and help to control contingencies that arise during the process. Project-management tools, along with electronic communication, enable ongoing communication of the reengineering

process between users and facilitators. Project teams can access a special Web site set-up as a hub for the project. The Web site could, for example, contain everything from tasks and schedules to a vast repository of engineering drawings, maps and other documents. Project teams can simultaneously access schedules and reports, manipulate information and give instant feedback. Managers can delegate tasks, coordinate shared resources and receive status updates.

- Gathering and analyzing information about the performance and structure of a process is important step in identifying and selecting process for redesign. Mapping or flow-charting the existing process and then measuring the results in terms of cost, quality and time are the most successful. IT can facilitate this step with the use of tools that provide modeling and flow simulation, document business processes, analyze survey data, and perform structuring evaluation. Technologies such as computer-aided systems engineering (CASE) are designed primarily to draw process models. The ability to draw models and make changes rapidly speeds redesign and facilitates the "process" of process design. At Xerox, for example, several divisions are moving directly from process modeling to automated generation of computer code. They report high user satisfaction and improved productivity with the resulting systems (Davenport and Short, 1990). In addition, IT is capable of storing and retrieving unstructured, multimedia information that can be useful for developing process prototypes. The maintenance and operating workers at Union Carbide's plant in Taft, Louisiana used flow-charting to redraw their old process and create new ones. The results were a saving of more than $20 million (Stewart, 1993).
- Computing technologies like database technology have facilitated a process-oriented approach to system development where a database is shared in different functional units participating in the same business process. Ford Motor Corp., for example, used relational databases in its accounts payable process to cut down many intermediate steps and to overhaul a sequential flow of paper documents among involved functions. As the project progressed, the reengineering efforts achieved a 75 percent reduction in the workforce. In addition to shared databases, imaging technology has facilitated a process-oriented approach because in processing loan applications, for example, the digitized image of an application can be worked on by several employees directly (Hammer and Champy, 1993; Teng *et al.*, 1994).
- Telecommunication technologies such as local area networks, groupware, etc. have improved collaboration among personnel of different functional units in their efforts to accomplish a common business process. At Texas Instruments, for example, the process for new product development was dramatically improved when a design team in different countries used

global network and advanced computing resources to work on design directly without sequential flow of documents. As a result, the development cycle time for various products decreased substantially (more than 30 percent in some cases) (Magnet, 1992). At Ford, the process for new car design was improved when computer-aided design (CAD) systems were utilized. Relying on CAD, member of design teams share a common design database across the Atlantic to exchange design ideas, criticism, and opinions without meeting face to face (Davenport and Short, 1990).

- It is important to gather business data at every step of the way and in every interaction with the customers. Making data digital from the start can provide a whole range of positive results. When figures are in electronic form, employees can look at them in any detail or in any view they desire, can study them and pass them around for collaboration. Going digital facilitates the process design by providing an immediate, constant flow and rich views of the right information for those who need to act. For example, Seven-Eleven Japan used IT to not only improve inventory control, but to provide key information to management and improve quality of sales information to make better operation decision on a regional basis. In 1979 the company established an online network and from there introduced the electronic point of sale (EpoS) system in 1982 (Sutherland, 1995). At Hewlett-Packard Co., the sales process improved drastically as 135 sales representative were trained to use laptop to retrieve up-to-date inventory information from the corporate database during the customer meetings. In addition, sales persons used these laptops to communicate with their peers and superiors. As a result, time spent in meeting decreased by 46 percent, travel time was cut by 13 percent, time spent with customers increased by 27 percent and sales rose by 10 percent (Berger *et al.*, 1987). The Web is providing new ways for companies to handle information. Technologies like customer relationship management (CRM) have been growing steadily for the last few years to reengineer the relationship between the customers and the organizations. CRM concentrates on the retention of customer by capturing customer data from every interaction, from multiple access points (phones, mail, Web or field) and then consolidates and transforms it into personalized predictive knowledge. Cisco Systems has used the Web-based CRM technology to create a "virtual enterprise". Barriers to information at Cisco are incredibly low. The company has been successful in opening the guts of its organization as much as it can to its customer. The customer can deal not only with front office, but gain access to knowledge and information they need at a particular point in time. The company has saved over $270 million in annual operating expenses while

improving customer satisfaction. CRM eliminates estimated 75,00 customer phone calls per month (Thompson, 2002).

- Input from employees and information on customer requirements is essential in reengineering analysis and design. IT applications would allow organizations to build data base to track customer satisfaction measurements, analyze complaints and get employee's feedback for ways to improve customer satisfaction. At Frito Lay, for example, each of the 10,000 salespersons uses a hand-held computer to record sales data on 200 grocery products, reducing many clerical procedures. The data is transmitted each night to a central computer, which, in turn, sends instructions such as changes in pricing, and product promotions to all salespersons through their hand-held computers. This process greatly enhances collaboration between marketing and sales and also makes weekly summaries and analysis available to senior managers (Malone and Rockart, 1991).
- IT capabilities are used for information exchange and to improve inner organizational collaboration. For example, R.J. Reynolds Tobacco Co. used EDI technology in conjunction with varied technologies of electronic commerce such as document imaging with electronic work queues to reengineer its accounts payable function. The Internet facilitates B2B transactions such as ordering, invoicing and payment, reduces the cost of procurement, and shortens lead times. It also can improve coordination and collaboration, both within and across companies. Using the power of the Internet, IT can facilitate information sharing and data exchange. In this type of relationship a partner is given access to information or one partner transmit/share information to/with other. To further enhance a buyer-seller relationship, some trading partners are moving toward more collaborative relationships. In 1995, Wal-Mart along with Warner-Lambert, Surgency, and software companies SAP and Mnugistics, spearheaded an effort to define a process that would link customers demand with replenishment needs through the entire supply chain. The result was a set of business processes, called CPFR, that help eliminate demand and supply uncertainty through improved communications between supply chain partners (Lothair, 2001).
- IT can also be used to help identify alternative business processes or other enablers of BPR. With the advancement in information technologies, information poverty is replaced with information richness. Furthermore, IT can help companies to achieve multiple objectives in redesigning processes. Expert systems and technological databases can provide information on current and future capabilities of technology, human resources and organization change. American Express, for example, improved quality, cost, and time of its credit authorization process by using expert systems. This technology incorporated the

knowledge of American Express best authorizers in an "Authorizer's Assistant" expert system. The successful redesign led to 25 percent reduction in the average time for each authorization, a 30 percent reduction in improper credit denials and a 7 million annual reduction in costs due to credit losses (Davenport and Short, 1990). Instead of being stuck with variations on the old paper processes that gives you at best incremental improvements, the IT makes it possible to develop much richer processes. The IT must support fundamental changes to the underlying processes and not simply be applied to the old, inefficient processes. "Though shall not automate junk".

Phase 3. After the design is complete (as an implementor)

The bulk of the reengineering efforts lie in this phase. During this phase, the reengineering efforts include planing and managing people, processes and technology and driving the implementation toward the business vision. The objectives of this stage are to pilot test the new approach, to continuously monitor the results, and to provide extensive retraining of employees. Top management support is critical. As reengineering efforts go forward it is important to define and redefine performance goals and objectives, maintain a strong commitment to the vision, break the barriers between the departments, and be flexible as the business environment changes.

IT can facilitate the following processes in this phase:

- IT can facilitate implementation of the new process through the use of project management and process analysis tools. These tools help identify structure and estimate all associated reengineering activities. They facilitate tracking and managing employee's expectations against commitments. This enables all involved parties to be aware of what is to be delivered in the end. Contingencies and problems that arise during the implementation phase can be handled and controlled.
- Electronic communications enable ongoing and real time communication of the reengineering process between users and facilitators. IT helps to overcome geographic barriers resulting in broader acceptance of the process change.
- Evaluating the potential investments and returns of the reengineering efforts is absolutely essential at this phase. The key question is how can the value of any specific reengineering process in the company operation be objectively questioned? The reengineering team or management should have enough information to determine how much value the new process contributes to the overall performance. IT can greatly facilitate this step with the use of tools that analyze survey data and perform structuring evaluation or perform simulations. Pacific Bell developed process value estimation (PVE) methodology to compute the amount of value-added by a given process before and after BPR effort. Pacific Bell management is using the methodology to target "right" process for

reengineering and to evaluate the changes that have made and the returns of the reengineering efforts (Housel *et al.*, 1994).

- A fundamental source of difficulties for companies struggling to implement reengineering is the fact that process gets reengineered and infrastructure doesn't. The existing rigid infrastructure of the organization must be altered to facilitate cooperation and to cross-functional barriers between departments. Cross-functional teams must replace individual working in isolated departments. This requires flattened organizational structure where there is still a clear-cut chain of authority, responsibility, and decision-making, but information access is faster and more efficient. Directions, instead of decisions, come from the top. Recently, there has been a significant growth in collaborative computing products. These products range from software for conducting meetings online to more complex programs that enable a number of users to collaborate in real time, sharing documents, managing projects and handling different tasks. With collaborative computing, teams can easily set up a workspace on the Web where they can share documents and discuss ideas. Employees can attend meetings regularly, without leaving their offices. These meetings are either synchronous, such as with chat rooms, or asynchronous, like message boards. The products and services in this category perform a wide range of meeting functions. These include idea generation, brainstorming, group outlining, voting, teleconference, meet-me-service, etc.
- As other business divisions undergo reengineering process, IT organization should be improved to meet the increasing needs of these divisions. For example, in 1993 CIGNA implemented reengineering of its 1,000-person IT department – CIGNA Technology Services (CTS). The main drive for reengineering was to meet the increasing needs of the business divisions as those divisions underwent reengineering processes. A team based structure resulted, and the benefits included a major change in the philosophy of the unit. Where the unit was previously technology focused, reengineering brought about a focus on using technology to meet business strategies. Management style changed from control-based and functional, to leadership-based and team-oriented. The hierarchy was flattened, increasing flexibility. In short, the department recognized that they served at the pleasure of the business units, and the job of CTS was to enable the business divisions to do their job in the most productive manner (Bower *et al.*, 1994).
- One of the grand rules of reengineering is that you need to step back periodically to take a hard look at your processes. "Digital feedback loop" makes it possible to have a specific definition of success, a specific beginning and end in terms of time and tasks, intermediate milestone and finally a budget.

The current state of reengineering

Many companies realized the impact of business process reengineering and considered reengineering to be the productivity breakthrough of the 1990s. American businesses spent more than $100 billion on various reengineering projects in the last decade.

Reengineering efforts have produced a wide range of results. Some users achieved large cost reductions, higher profits and throughput, improved quality and productivity, faster response to market, and better customer service. In many of these firms, IT played an important role in process redesign. IT applications stem from a combination of breakthrough ideas and from modifying the ideas that have succeeded or failed at other companies.

In the last five years, combination of global competitive pressure and the frustrating inefficiency in work relationships between organizations and customers/suppliers forced companies to invent new ways of doing business. For sustainable competitive advantage, companies are using IT-enabled processes to move beyond the easily duplicated automation projects and to connect their organizations with other partners to create win-win relationship. Champy calls this process X-engineering, the extension of reengineering to processes outside of organizations. These changes are enabled, of course, by the power of the Internet and its associated technologies. The Internet has emerged as a driving force and a platform for the development of innovative products. Web-based products are designed to grab information from the Web automatically, posting content to it simply, and using the Net as virtual office space where employees can meet and share information. Thanks to investment in supply chain management (SCM), CRM and Web-based procurement, quality is up, while costs and cycle times are squeezed to previously unthinkable levels (Table II).

Summary

The rapid evolution of information technologies and its declining costs are creating opportunities for organizations to dramatically change and improve the way they conduct business. IT provides strategic value to an organization by giving support to the administrative infrastructure, business processes, and operational skills of staff. It is used for cost reduction, product differentiation, quality improvement, integration with customers and suppliers, organizational learning, and creating new business opportunities. IT is the most effective enabling technology for BPR. It helps in meeting the objectives of reengineering in three ways: By providing information across functional levels and establishing easy communication, improving the process performance and finally by helping the reengineering effort by modeling, optimizing and assessing its consequences.

IT can play an important role in success of reengineering, but only when the organizations adopt a change in mindset regarding the role of the IT function –

Table II. Reported IT-enabled reengineering successes

Company	Process	Role of IT	Reported benefits
American Express	Credit authorization	Expert system was used to achieve multiple objectives in redesigning credit authorization	$7 million annual reduction in costs 25 percent reduction in the average time for authorization 30 percent reduction in improper credit denials
Cisco Systems	Customer relationships	Web-based CRM technology is used to create a "virtual enterprise"	Reduced over $270 million in annual operating expenses Eliminated 75,00 customer phone calls per month
Colgate-Palmolive	Supply chain	The Internet technology is used to enables the company to perform supply chain planning and logistics execution across the boundaries of the enterprise	10 percent reduction in inventory level 95 percent improvement in customer order fulfillment
Deere & Co.	Product development	CAD and CAM are used for design, production and materials management	Reduced inventory costs Decreased manufacturing overhead
Dell Computer	Supply chain	Internet based technology to fulfill individually customized products with delivery target of five days or less	Reduce inventories to a five day's worth, down from 13 in 1997, resulting in a $50 million saving
Emerson	Procurement	A Web-based system called Materials Information Network (MIN) is sued to store information about preferred suppliers, special pricing, and detailed product specifications on the materials company uses to make products	Consolidates buying activity across 60 divisions MIN saved the company $30 million in 2001 and it is estimated to save $500 million by 2005
FedEx Corp.	Procurement	The Internet technology is used to automate and streamline its whole paper-based inefficient procurement processes	Purchasing cycle times have been reduced from 20 percent to 70 percent Number of suppliers have been reduced by more than half Better service for its own employees

(continued)

Table II.

Company	Process	Role of IT	Reported benefits
Ford Motor Corp.	Accounts payable	Relational database overhaul a sequential flow of paper document Imaging technology facilitates a process-oriented approach	75 percent reduction in workforce, from 500 to 125 14 day reduction in payment time to suppliers
Frito Lay	Purchasing	Hand-held computer records data on grocery products	Saved 30,000 to 50,000 work hours per year Lowered the sales staff by 600 people Eliminated 10 percent of the distribution centers
Hewlett-Packard Co.	Sales process	Laptop computers were used to provide frequent exchange of sales intelligence and corporate directives	46 percent reduction in time spent in meetings 27 percent increase in time spent with customers 10 percent increase in sales
Pacific Bell	Billing department	New printing technology	30 percent reduction in paper consumption $10-12 million reduction in postage costs
Palm, Inc.	Supply chain	The Internet technology is used to enables the company to shorten planning cycles, increase visibility, and improve logistics and control	50 percent reduction in planning cycle time 32 percent reduction in overall inventory level Inventory turnovers were improved from 6 to 10
R.J. Reynolds	Accounts payable	EDI, electronic receipt settlements and imaging technology with electronic work queues reengineer accounts payable function	53 percent reduction in invoice processing costs 25 percent reduction in clerical staffing requirements 16 percent annual increase in transactions volume

(*continued*)

Table II.

Company	Process	Role of IT	Reported benefits
Texas Instruments	Product development	Global network and advanced computing resources enable design teams in different geographic areas to work on pre-design development without meeting face-to-face	30 percent reduction in time needed to develop an instrument
Wal-Mart	Procurement/distribution process	EDI and bar scanners provide just-in-time inventory levels Satellite systems are used for data transmission between sites	2 percent cost advantage over its nearest competitors
Seven-Eleven Japan Co., Ltd.	Inventory control	Point-of-sale (POS) and electronic ordering enhance business efficiency Satellite communications and an integrated services digital network (ISDN) are used for data transmission between stores and district office	Enhanced information-sharing among stores, headquarters and suppliers Enhanced business efficiency Improved overall ability to meet customer needs

a mindset of being the provider of data management expertise rather than being the guardians of the information systems. Without visionary leadership and support from the top most IT changes will be ineffective and there is little chance that innovative forces can be mobilized to facilitate process redesign and organizational transformation.

Successful reengineering requires that companies first concentrate on crucial business processes that effect competitive factors, customer service, cost reduction, product quality and time-to-market. Obtaining greatest benefit from IT requires that current processes not be simply automated or existing automation improved. Instead, the processes themselves must be reengineered before being automated. The goal should be dramatic change and not incremental improvement.

The lesson from reengineering is loud and clear – IT is only useful if it helps employees do their work better and differently. Organizations are throwing money at technology instead of working with the employees in the organization to infuse technology.

The most important IT role is to avoid being an inhibitor or disabler to reengineering because of difficulties in modifying existing systems. In many cases, IT was the biggest barrier to rapid and radical change because radical change required IS redesign. IT is clearly an enabler of reengineering. In many cases redesign process cannot be implemented until employees can access new sources or domains of information. As Hammer and Champy stated the their famous article, IT partnership with managers rather than IT leadership of reengineering is generally a key to successful reengineering.

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