Tutorial

Business process reengineering: A tutorial on the concept, evolution, method, technology and application

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Accepted 20 November 1996

Abstract

It is ironical that while much is being discussed about business process reengineering (BPR), most companies are still searching for methods to better manage radical change. Academics are studying the phenomenon but precious little has been published. Many basic questions remain unanswered. What does reengineering involve? Are there methods for effectively accomplishing BPR? Why is it so popular? Is there a logic behind reengineering? Is BPR fundamentally different from old Taylorian approaches to industrial engineering based on task decomposition and specialization? Is BPR the same as TQM, restructuring, etc.? What is the relationship between process redesign and organizational structures? How do we best plan, organize and control BPR efforts? Under what conditions will BPR be most effective? Answers to these questions are neither easy nor direct. However, this tutorial seeks to address them in a systematic, comprehensive and unbiased manner. In doing so, the tutorial will attempt to synthesize a variety of material from both practitioner and academic literature sources into a coherent précis that defines and discusses BPR in a language palatable to both the manager and the academic. A variety of frameworks will be presented to clarify the nature of the phenomenon as prescribed (in theory) and as companies are learning about it (in practice). The objective of this tutorial is to inform rather than provide an academic discourse.

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Keywords: Reengineering; Process management; Technology

1. The hype

Reengineering, or business process reengineering (BPR) as it is commonly called, is the buzzword of the 1990s. The dramatic success stories have been touted again and again in the popular press: ‘‘Ford cuts accounts payable headcount by 75%’’; ‘‘Mutual Benefit Life improves insurance underwriting efficiency by 40%’’; ‘‘Xerox redesigns its order fulfill-
BEFORE

A number of paper documents were processed sequentially by 3 functions who participate in the process indirectly with a work force of 500 clerks to perform many intermediate steps:

- The purchasing function issues a purchase order to the supplier and sends a copy to the accounts payable function.

- Upon arrival of purchased goods, the inventory function sends a copy of the receiving document to the payable function.

- When the invoice from the supplier arrives in the mail, the payable function matches it against the purchase order and the receiving document before issuing payment to the supplier.

- Much efforts are needed to resolve frequent discrepancies between the documents, and a total of 14 data items must be checked in the process.

Fig. 1. Two examples of business process reengineering: (a) Ford's accounts payable process, (b) Detroit Edison's work order process. (Adapted from Hammer, 1990.)

AFTER

With a work force of only 125, the 3 functions participate in the process directly by accessing a shared data base, eliminating many intermediate steps and sequential flow of paper documents:

- The purchase order is entered into the shared data base by the purchasing function.

- Upon receiving goods, the inventory function accesses the data base. If a match is found, the goods are shipped and the status of the order in the data base is updated. Otherwise, the goods are returned to the sender.

- The payable function routinely access the data base to prepare payment checks for orders that have changed status, and invoices from suppliers are eliminated.

- Matching and discrepancy resolution of paper documents are no longer needed, and only 3 data items need to be checked in the process.
the topic have become phenomenal bestsellers with millions of copies sold. Consultants are repackaging old methodologies in glossy brochures and charging thousands for their claimed proprietary solutions. Surveys of senior executives indicate that reengineering is the number one initiative taken by companies to achieve strategic goals. Academics, both cynics and proponents, are beginning to jump on the bandwagon and write scholarly prose on why they have seen it all before or why such a radical change is good. All this in the midst of our increasingly competitive global economy, corporate downsizing and layoffs and incredible improvements in computing technologies.
2. How did this all start?

We can only speculate as to the origins of reengineering. However, it seems that a number of converging occurrences provided the impetus for the concept and mobilized its subsequent popularity.

2.1. Consultant programs

Around the mid-1980s, the idea of redesigning business processes was being advanced by large consulting units such as Peat Marwick and McKinsey. Index Group and Michael Hammer directed programs on cross-functional systems in which several firms were studied (including Mutual Benefit Life and Ford). These firms used many of the components of reengineering, particularly the notion of information technology (IT) to make radical changes in cross-functional processes.

2.2. Process focus

The idea of improving business processes was also prominently discussed several years ago. Total quality management (TQM) and continuous improvement as a part of the “quality movement” focused on Japanese kaizen or continuous improvement. The focus of this movement was on statistical process control and following quality guidelines and standards. Further, quality, service and time based competition all brought the notions of process and performance into management agendas.

2.3. Economic pressures

The recession through the late 1980s and early 1990s stimulated managers to think of new ways to reduce costs. Increasing global competition further squeezed profits and led to reactive approaches and cost cutting/downsizing programs. The bulging middle manager levels which focus on white-collar processes came under particular pressure in these programs, which were also aimed at increasing a company’s ability to be flexible and responsive.

2.4. Productivity paradox

Investments in technology are expected to improve productivity. Yet this did not happen, leading to the phenomenon generally referred to as the “productivity paradox”. Proponents of the productivity paradox have been touting the large dollar investments in IT (about $900 billion in the past 10 years) in the high growth services industry, with minimal productivity growth (estimated at around 0.7%). In response to the attention generated by the productivity paradox, companies that had spent (and were spending) vast amounts of money on newer and more powerful ITs attempted to leverage these investments by tying them to process changes.

2.5. Legitimacy

Much of the reengineering phenomenon was legitimized by two early seminal articles on the topic (Davenport and Short, 1990; Hammer, 1990) that appeared in journals with an audience that included both academics and practitioners. This was followed by books entitled Reengineering the Corporation (Hammer and Champy, 1993) and Process Innovation (Davenport, 1993). Both these books were tremendously popular and spurred a lot of reengineering activity in both practice and academia.

2.6. Bandwagon effect

Some of the early aggressive adopters of reengineering like Cigna, MBL, Xerox, IBM, etc. were highly publicized in the popular press. Consulting firms and vendors (with their own vested interests) began to repackage their products and market proprietary solutions for reengineering. The rhetoric of

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1 Innovative use of advanced IT, however, can inevitably lead many firms to develop new, coordination-intensive structures. These new structures can leverage the potential of IT as illustrated by the Frito-Lay case. With a sales force of 10,000, keeping the traditional hierarchical structure would lead to many layers of middle management in order to absorb the colossal amount of communication and coordination. At Frito-Lay, however, a coordination-intensive structure was developed to replace the traditional hierarchy with the aid of IT. A hand-held computer is given to each of the 10,000 salespersons to record sales data on 200 grocery products. Each night, the data is transmitted to a central computer which will send instructions back to the hand-held computers on changes in pricing and product promotions the next morning. In addition, weekly summaries and analysis are available to senior executives through an executive information system (Malone and Rockart, 1991).
reengineering transcended the original concept and was often used to describe any change or system initiative.

Therefore, it can be said that the notion of reengineering came at the right place at the right time. Pushed by consultants at a time when businesses were looking for answers on how to compete effectively in the changing marketplace, the concept was embraced. However, since its original conception various realities of accomplishing radical change and minimizing the pain have set in, especially since recessionary pressures in the US economy have been somewhat alleviated. The reengineering concept is being modified with this reality in mind. Reengineering both in its classical sense and in terms of its evolution will be discussed next.

3. Classical reengineering

Business process reengineering, process improvement, business transformation, process innovation and business process redesign are terms frequently used interchangeably. Competing definitions of BPR proposed by leading practitioners are (Grover et al., 1993):

- "the analysis and design of work flows and processes within and between organizations";
- "a methodological process that uses information technology to radically overhaul business process and thereby attain major business goals";
- "the reconfiguration of the business using IT as a central lever";
- "overhauling of business processes and organization structures that limit the competitiveness, effectiveness, and efficiency of the organization";
- "the fundamental analysis and radical redesign of business processes to achieve dramatic improvements in critical measures of performance".

Four elements of these definitions seem to stand out and form the nucleus of reengineering:
1. it consists of radical or at least significant change;
2. the unit of analysis is the business process as opposed to departments or functional areas;
3. it tries to achieve major goals or dramatic performance improvements;
4. IT is a critical enabler of this change.

These four elements provide a working definition of reengineering. In other words reengineering is about significant change and a rethinking of why we do things the way we do—and not about tinkering with or speeding up what is already in place. Reengineering is not about fine tuning or 5–10% improvements. Stretch goals for reengineering are sometimes in the order of multi-fold performance improvements in cycle time, quality, customer service or cost—which cannot be accomplished without revamping existing processes, or often redesigning them from a clean slate.

The focus of improvement by necessity is thus the business process, which is the collection of activities or tasks that create outputs of value to a customer. These activities could be value-adding activities which are of importance to the customer, hand-off activities that move work across organizational boundaries, or functions and control activities that control/approve movement of work flow. Order fulfillment, for instance, takes an order as an input and follows a sequence of activities, approvals and hand-offs until the process results in the delivery of the ordered goods. In most cases (but not all), the power of modern information technology, both computing and communication, plays a major role in transforming slow sequential tasks into parallel simultaneous tasks whereby enhancing communication between tasks can lead to the achievement of these dramatic performance improvements.  

Reengineering in the classical sense can also be differentiated from other programs such as TQM, right sizing, restructuring and automation. The hyperbole surrounding reengineering often makes it difficult to differentiate between these change programs. Table 1 summarizes key dimensions of these programs. Rightsizing and restructuring are typically used to refer to adjustments in staffing requirements and changes in formal structural relationships, respectively. Neither approach focuses on the business process. Automation refers to typical application of technologies (including IT), where the application

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2 American Express Company’s wide-scale reengineering of processes at its largest business unit, Travel Related Service, has cut more than $1.8 billion in operating expenses over the past two years. Such a reduction has been made possible by over 200 projects involving significant change, many involving IT, that have been conducted at this business unit since 1992 (Maglietta, 1994).
Table 1
Reengineering and other change programs

<table>
<thead>
<tr>
<th>Assumptions questioned</th>
<th>Rightsizing (downsizing)</th>
<th>Restructuring</th>
<th>Automation</th>
<th>TQM</th>
<th>Reengineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus of change</td>
<td>Staffing</td>
<td>Reporting relationships</td>
<td>Technology applications</td>
<td>Customer needs</td>
<td>Fundamental</td>
</tr>
<tr>
<td></td>
<td>Staffing, job responsibilities</td>
<td>Organization</td>
<td>Systems</td>
<td>Bottom-up improvements in many places</td>
<td>Radical changes over broad core entities</td>
</tr>
<tr>
<td>Orientation</td>
<td>Functional</td>
<td>Functional</td>
<td>Procedures</td>
<td>Processes</td>
<td>Processes</td>
</tr>
<tr>
<td>Role of IT</td>
<td>Often blamed</td>
<td>Occasionally emphasized</td>
<td>To speed up existing systems</td>
<td>Incidental</td>
<td>Key</td>
</tr>
<tr>
<td>Improvement goals</td>
<td>Usually incremental</td>
<td>Usually incremental</td>
<td>Incremental</td>
<td>Incremental</td>
<td>Dramatic and significant</td>
</tr>
<tr>
<td>Frequency</td>
<td>Usually one time</td>
<td>Usually one time</td>
<td>Periodic</td>
<td>Continuous</td>
<td>Usually one time</td>
</tr>
</tbody>
</table>
focuses mainly on automating existing procedures without questioning their appropriateness or legitimacy. 3

Both TQM and reengineering focus on processes. However, TQM involves bottom-up participation, usually within function, continuous evaluation of current practices resulting in incremental changes in work design. Reengineering, on the other hand, is typically initiated from the top down, focuses on broad cross-functional processes, questions the logic of existing designs and is usually a one-shot attempt at achieving quantum improvements. IT, while only incidental to TQM, is often a key enabler of reengineering. All the same, TQM can often serve as the building block for subsequent BPR efforts. 4

4. The logic of reengineering

Reengineering brings the different views of quality, information technology, organizational change, innovation and work redesign together. As such it represents an input–output activity view of the business as opposed to a functional, responsibility-centered structural view. Such a horizontal view of the business represents a paradigm shift from the traditional hierarchy-based vertical view.

The hierarchy that evolved through the post-World War II era is the most efficient command and control structure. In environments characterized by stability, limited uncertainty and limited “consumerism”, the hierarchy works. It works when the objective of companies is to grow without going broke. It works when people are subservient to the structure and can follow rules defined by their position. It works when markets do not change rapidly and the focus is not on flexibility, quality, service and innovation.

Reengineering proponents observe that functions and hierarchies are vertical views of organizations that often involve decisions that are translated down the hierarchy and result in choices that are best for the function, not the organization. Functions do their job and hand off work and responsibility to other functions. Adam Smith’s principles reflect that some number of specialized workers, each performing a single step in the manufacture of a pin could make far more pins a day than the same number of generalist workers each making whole pins. Traditional organizational forms reflect these principles, whether being applied to processing insurance forms or to manufacturing a product. With time, functions, positions and specialists proliferated, as did bureaucracy and the rules to handle increasing contingencies. Along with growth in rules, tasks and complexity was the pyramid management structure needed to put all the pieces together. The problem is that many companies are paying more for the glue than for the real work. 5

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3 When IBM’s disk drive facility in San Jose, CA, overhauled its plant, the product—a disk storage unit—was reengineered. This simplified the task of automating the process. At Smith Carona, reengineering has not led to extensive automation. Instead, the company has restructured its manufacturing operations to become more competitive (Boudette, 1990).

4 A survey was recently conducted within different industries in the UK to ascertain the level of integration between BPR and TQM. It confirmed that different organizations and industrial sectors differing emphasis on the various tools and techniques of BPR. Firms that adopt TQM show greater use of strategic and process management techniques, which in turn places them in an ideal position to consider reengineering in the future (Zairi and Sinclair, 1995).

5 “… specifically the chains of command, the lines of authority, the very stuff that held (Alfred) Slaon’s automation together, that are groaning and popping the loudest. For what’s happening is an internal power shift to match the external one from management out to the free markets. Customers, flexing their new muscle, are growing ever more exacting, even uppity. And how do they express their power? They’re always asking to speak to the person in charge! But who is in charge? … Such a person, if he exists, is just a name in a box on the organizational chart, and what the person wants, the name-in-a-box probably can’t give him. The customer wants help, service, product or solution to a problem. He doesn’t want someone whose only possible role in the affair might be to tell someone else to give him what he wants … And with neat, logical and altogether drastic redesign, the whole of Mr. Sloan’s wonderfully rational machine falls apart. For to say that the person in charge is the person who can help the customer is to make entire branches of the old organization chart ‘redundant’ … meaningless, and their inhabitants irrelevant. Why? Because their meaning and power … were always internal; that is, wholly concerned with the functioning of the machine itself. The great corporate vessels of the Sloan sort were really cruise ships … majestic powers of command and control for their top officers, yes; but for all the other officers on board, not much more than a floating system of rewards, promotions, and privileges—in a phrase, a self-serving bureaucracy’ (Champy, 1995, pp. 20–21).
A process view observes organizations horizontally. Both ends of the process have customers. Reengineering reflects this horizontal view by emphasizing notions of processes, process owners, teams and empowerment, and de-emphasizing hierarchical structures. Fig. 2 illustrates how a process (horizontal view) exists in the vertical organization. Several concepts are associated with such a view of organizations.

4.1. Process / customer focus

Every process has a customer that might be either internal or external to the organization. By focusing on the process and putting people in charge of processes that are important to customers, an organization can reduce confusion and suboptimization across functions, enhance customer responsiveness, and increase accountability and performance of the entire process.

4.2. Empowerment

Reduction of wasteful activities of such processes can be accomplished by compressing hierarchical organization structures, empowering workers, and reducing the “up-and-down” information flow across a process. In other words, decision making becomes a part of the work rather than separate from it. The more educated and skilled work force of today can revel in an empowered environment. Such empowerment can reduce approval delays, compress lead times, and improve customer service.

4.3. Interaction

Cross-functional teams working on common processes and tighter integration across functions reduces inefficiencies in a process. A broader (general) understanding of a process rather than a parochial function, joint responsibility for a process and compensation schemes based on performance not position can lead to more challenging jobs and processes that are both efficient and effective.

However, to accomplish the transformation from the vertical to the process-based organization requires radical rethinking of existing processes that have been indoctrinated into the organizational culture for years and have gathered layers of bureaucracy over time. This requires not only a strong commitment from top executives, but also a significant management of change.

5. How can it be done?

Reengineering is a challenge in every sense of the word. It requires “out-of-the-box” thinking about aspects of the organization that have been institutionalized. There is always comfort in the “way we have always done things”. Therefore, reengineering is as much about a program of change management as it is about effective project management. It also focuses on the larger cross-functional processes for which conventionally no one individual or group takes responsibility. Therefore, the impetus, leadership and championship through this endeavor must
come from the top of the organization. It requires mobilizing resources across functions, setting up teams representative of the entire organization, and effectively communicating the goals and objectives throughout the organization. If possible, the teams should also have some outsiders who can bring in fresh perspectives and new ideas. Often the lack of adequate attention to the ‘people’ aspects of reengineering is what causes the greatest problem.\(^6\)

Most methodologies for conducting reengineering are the intellectual property of large consulting firms (e.g. Andersen Consulting, CSC/Index, Ernst and Young, McKinsey, SRI, etc.). These methodologies often involve modeling techniques. For instance, a suite of modeling techniques (known as Integrated DEFinition or IDEF) collectively serve as an efficient means of process analysis. The various methodological approaches typically proceed through a series of stages and vary depending on their particular orientation toward reengineering. For instance, some might focus on redesigning existing processes, while others might take a more radical “greenfield” approach. Alternatively, some focus on the link between strategic goals of the organization and process redesign, while others emphasize only the systems tools to document new processes. However, despite these differences, these methods generally look at six generic phases. A brief description of these phases follows, while other aspects are summarized in Table 2.

5.2. Process-think

This stage involves building and understanding a customer-based process model of the business. This understanding includes definitions of customers and processes, as well as performance measures of process success. An analysis of value-adding activities (i.e. of visible importance to customers) and process mapping can enable the diagnosis of process problems and opportunities. Processes that contribute to the core competencies of the organization can be identified and evaluated as candidates for the reengineering effort, with the eventual prioritization focusing on those processes that leverage and enhance the firm’s competitiveness.

5.3. Creation

In this stage, the primary focus is to identify current process elements, such as organization, systems, information flows, etc., and a new process “vision” on what changes are required in order to achieve the desired changes in performance. This can be done based on looking only at the essence of existing processes and brainstorming alternative implementations, or by redesigning the process completely after carefully evaluating its objectives. Benchmarking of best practices for the selected pro-

\(^6\) In response to rapid changes in the telecommunications industry, process reengineering at GTE Telephone operations is taking place in five distinct stages: (1) discovering how things actually work at GTE; (2) harvesting whatever savings and efficiencies can be quickly derived from process reengineering; (3) identifying best practices among the best US companies, creating conceptual platforms for the new processes, and integrating everything to maintain a focus on the customer; (4) devising implementation plans; and (5) achieving full-scale implementation (Allen and Nafius, 1993).

\(^7\) At Charles Schwab Corporation, top management undertook this strategic approach to reengineering planning and identified 24 interrelated business processes representing every activity of the brokerage firm. Silicon Graphics created a process consulting group headed by a director. At Hallmark, a formal senior position has been established for reengineering (Davenport and Short, 1990, Stewart, 1992).
<table>
<thead>
<tr>
<th>Central questions addressed</th>
<th>Key activities</th>
<th>Types of tools/techniques</th>
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</thead>
<tbody>
<tr>
<td>Preparation</td>
<td></td>
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<tr>
<td>• What is the level of commitment of senior executives?</td>
<td>Evaluating organization and environment, recognizing need, setting corporate and reengineering goals, identifying and motivating team, training team on reengineering concepts, development of a change plan, development of project scope, components and approximate time frames.</td>
<td>Planning</td>
</tr>
<tr>
<td>• How can reengineering address our business goals?</td>
<td></td>
<td>• Team building</td>
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<tr>
<td>• Who should be represented on the reengineering team?</td>
<td></td>
<td>• goal seeking</td>
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<tr>
<td>• What skills will team members have to learn?</td>
<td></td>
<td>• motivation</td>
</tr>
<tr>
<td>• How do we communicate this effort to employees?</td>
<td></td>
<td>• change management</td>
</tr>
<tr>
<td>Process-think</td>
<td>Model processes, model customers and suppliers, define and measure performance, define entities or &quot;things&quot; that require information collection, identify activities, map organization, map resources, prioritize processes.</td>
<td>• Customer modeling</td>
</tr>
<tr>
<td>• What are our major business processes?</td>
<td></td>
<td>• Performance measurement</td>
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<tr>
<td>• Who are their customers?</td>
<td></td>
<td>• Cycle time analysis</td>
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<tr>
<td>• What are our strategic/value-added processes?</td>
<td></td>
<td>• Cost analysis</td>
</tr>
<tr>
<td>• What processes get highest priority for reengineering?</td>
<td></td>
<td>• process modeling</td>
</tr>
<tr>
<td>Creation</td>
<td>Understand process structure, understand process flow, identify value-adding activities, benchmark performance, brainstorm IT possibilities, estimate opportunity, envision the ideal process, integrate visions, define components of visions.</td>
<td>• Process value analysis</td>
</tr>
<tr>
<td>• What are our subprocesses, activities and steps?</td>
<td></td>
<td>• Benchmarking</td>
</tr>
<tr>
<td>• How do resources and information work through processes?</td>
<td></td>
<td>• Cycle time analysis</td>
</tr>
<tr>
<td>• Why do we do things this way?</td>
<td></td>
<td>• brainstorming</td>
</tr>
<tr>
<td>• What are the key strengths and weaknesses of our processes?</td>
<td></td>
<td>• visioning</td>
</tr>
<tr>
<td>• Can we benchmark? How?</td>
<td></td>
<td>• documentation</td>
</tr>
<tr>
<td>• Ideally how would we like these processes to work?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Can IT be used to transform these processes?</td>
<td></td>
<td></td>
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<tr>
<td>• What are our stretch goals for these processes?</td>
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<tr>
<td>Technical design</td>
<td>Social design</td>
<td>Implementation</td>
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<tr>
<td>------------------------------------------------------</td>
<td>----------------------------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>- What technical resources will we need?</td>
<td>- Examine process linkages, model entity-relationships, develop</td>
<td>- Develop test and rollout plans, construct system,</td>
</tr>
<tr>
<td>- How can these resources best be acquired?</td>
<td>performance metrics, consolidate interfaces, consolidate</td>
<td>monitor progress, evaluate personnel, train staff,</td>
</tr>
<tr>
<td>- How will all the technical elements work?</td>
<td>information, design technical systems, modularize, plan</td>
<td>pilot new process, refine, full rollout, continuous</td>
</tr>
<tr>
<td>- How will the technical elements interact with the social elements?</td>
<td>implementation. Empower customer contact personnel, identify</td>
<td>improvement.</td>
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<td></td>
<td>job clusters, define jobs/teams, define skills/staffing,</td>
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<td></td>
<td>specify organizational structures, design transitional</td>
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<td></td>
<td>organization, design incentives, manage change, plan</td>
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<td></td>
<td>implementation.</td>
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<tr>
<td>Social design</td>
<td>- Information engineering</td>
<td>- Information engineering</td>
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<tr>
<td>- What human resources will we need for the reengineered processes?</td>
<td>- Work flow analysis</td>
<td>- Work flow analysis</td>
</tr>
<tr>
<td>- How can we best acquire these resources?</td>
<td>- Performance measurement</td>
<td>- Performance measurement</td>
</tr>
<tr>
<td>- Who is likely to resist these changes and why?</td>
<td>- Process modeling</td>
<td>- Process modeling</td>
</tr>
<tr>
<td>- How will the social elements interact with the technical elements?</td>
<td>- Project management</td>
<td>- Project management</td>
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<tr>
<td>- What will the new organization look like?</td>
<td>- Employee empowerment</td>
<td>- Employee empowerment</td>
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<tr>
<td></td>
<td>- Skill matrices</td>
<td>- Skill matrices</td>
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<tr>
<td></td>
<td>- Team building</td>
<td>- Team building</td>
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<td></td>
<td>- Self-managed work teams</td>
<td>- Self-managed work teams</td>
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<td>- Case managers</td>
<td>- Case managers</td>
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<td>- Organizational restructuring</td>
<td>- Organizational restructuring</td>
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<td>- Change management</td>
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<td>- Incentive systems</td>
<td>- Incentive systems</td>
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<td>- Project management</td>
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<td>- Skill matrices</td>
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<td>- Performance measurement</td>
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<tr>
<td></td>
<td>- Just-in-time training</td>
<td>- Just-in-time training</td>
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<tr>
<td></td>
<td>- Project management</td>
<td>- Project management</td>
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</table>
cesses can be undertaken. Creative applications of IT are envisioned at this stage.  

5.4. Technical design

Once the redesigned process has been "envisioned," it needs to be documented. Technical design concerns descriptions of hardware, software, procedures, systems, and controls employed by the reengineered process. Plans are drawn up for procurement, systems, facilities enhancement, conversion and deployment.  

5.5. Social design

The technical design cannot be accomplished without considering social (people) aspects of the new process. Defining the problem, and then developing and selling the solution can be equally challenging. Staffing, jobs, career paths and incentives are considered in conjunction with technical design. Plans for recruitment, education, training, redeployment and morale are produced.

5.6. Implementation

This stage realizes the technical and social plans. It involves team-based implementations and produces pilot and full production versions of the reengineered process and continual change mechanisms.

Of course, describing a reengineering method is far easier than actually conducting it. No methodology is a substitute for thinking, and thinking differently is what reengineering is all about. A methodology guides reengineering and provides a vehicle for the analytic thought process rather than becoming a surrogate analyst. Critical success factors are active executive support, getting the "buy-in" from major interest groups, consideration of technical and social changes together, and effective project and change management. In fact, recently change management has come to the forefront as the critical success factor for reengineering. The depth and complexity of the organizational change that arises from reengineering is considerable. It is the most difficult aspect of business reengineering and involves the manage-

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\(^8\) A large toy manufacturer felt that the best way to recapture and expand market share was to focus on reengineering customer service processes. The management defined ambitious project goals and established a cross-functional team under the sponsorship of the Chief Executive Officer. This team included an outside IT consultant and a reengineering facilitator. Current customer-facing processes were evaluated by obtaining feedback from customers as estimates were made regarding time, risk and cost of changing processes. The company determined that the "fulfill orders" process had the greatest impact on its business objective of increasing market share. Twenty-three activities and 83 steps in the process were documented with information inputs, outputs, subprocesses, duration of steps, utilization of people and machines, value- and non-value-adding steps, etc. Using competitor-based benchmarks, the team documented opportunities for radical change by envisioning the ideal process with all internal performance measures optimized and again with all external performance measures optimized. Finally, the team determined that hand-held terminals and electronic data interchange systems appeared to have potential to contribute to exceptional performance. (Adapted from Manganelli and Klein, 1994.)

A benchmarking service at IBM identifies best practices in 20 different business processes. The purpose of the service is to assist the company’s manufacturing quality improvement program. The three categories of manufacturing business processes dealt with include physical transformation processes, product and process introduction, and materials management. As a result, plants have achieved greater than 40% reduction in cycle time and significant reductions in business process defects (Parker, 1993).

\(^9\) Cincinnati Milacron Inc. used Enterprisewide Information Planning (EIP) to examine the effectiveness of its information systems and the underlying business processes on which these systems are based. EIP’s fundamental goal is to tie a company’s business objectives and critical success factors into new and more effective process and information requirements throughout the enterprise. The projected benefits of the EIP program at Milacron include the development of a more competitive and customer-responsive organization (Cole et al., 1993).

\(^10\) The toy company described earlier designed the technical system for its "fulfill orders" process which included an on-line order processing system and expert systems for credit decisions, warehouse optimization and routing. The social design for the process included combining eight jobs into four empowered jobs, self-managed work teams, new career paths, new responsibilities for personnel development, and an organization restructured to keep almost all the processes within one group's responsibility. (Adapted from Manganelli and Klein, 1994.)
ment of politics and resistance, and communicating reasons for change. 11

6. What makes it easier

Reengineering is not a panacea that is simple to accomplish and appropriate for every organization. On the contrary, it requires careful evaluation and management to be successful. We first describe a framework that can be used to represent business processes. Within this framework, there are two general enablers of BPR that deserve explicit discussion. Broadly, these are referred to as IT enablers and organizational enablers, respectively. This framework is then used to illustrate how these two sets of technical and social enablers can facilitate process change.

6.1. Representing business processes

Most business processes that are reengineered are cross-functional. In other words, they contain tasks that transcend boundaries of functions such as marketing, production, accounting, etc. When a task is included in a business process, it typically develops tangible input–output relationships with other participating functions involving either transfer of physical objects, or hand-off of documents from one function to another. At one extreme of this physical coupling of inputs and outputs is the serial pattern, where the process consists of a large number of sequential steps performed by different functions. An example of this pattern can often be found in business expense processing which requires many layers of management approvals, auditor evaluation, and filing of receipts, etc. At the other extreme is the parallel pattern, where several functions contribute directly to the process outcome without intermediate steps. For example, both the manufacturing function and the advertising function are involved in the process of launching a new product, but the advertising function need not physically possess the product inventory or obtain authorization from the production function in order to advertise the product. Between these two extremes, there can be a mixture of both serial and parallel patterns representing diverse types of physical coupling between inputs and outputs of a process.

In addition to, and sometimes instead of, relying on tangible input–output to orchestrate their activities, various functions involved in a process may collaborate with each other through “intangible” information exchange to make mutual adjustments. The frequency and intensity of information exchange between two functions, termed “information coupling”, can range from none (completely insulated) to extensive (highly collaborative). Then most processes can be characterized by their degree of physical coupling and degree of information coupling. As illustrated by several examples listed below, the goal of a reengineered process is to attain a high degree of parallel coupling of inputs and outputs, along with a high degree of collaborative information exchange.

6.2. Enabler set 1: IT

Conceptually, an organization should be able to redesign a business process without the aid of IT. However, many recent successes in reengineering would be difficult to consummate without the enabling IT. All the same, appropriate application of IT should stem from an understanding of the nature of the business change desired. The reduction of physical coupling in process reconfiguration may be enabled through the application of shared computing resources such as database and imaging technology. Many firms have successfully capitalized on the enabling role of IT in reconfiguring their business processes from a highly serial pattern with many intermediate steps to a parallel pattern permitting several functions to proceed independently. In the

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11 A first-tier automotive supplier experienced a downward turn in business due to increased overseas competition. The president decided that the core competencies of the company would help them expand into the aerospace and agricultural businesses to counterbalance the downturn in the automotive business. The president set the general direction for change and allowed the organization to build the critical mass of support. Formal change began in one plant where the plant’s management and workforce together figured out how to reengineer for the new businesses. The president communicated the success of this plant to two other plants. As other plants initiated change, the president realigned the corporate structure and system to the new practices implemented. It can be presumed that any imposition of structure or system from the top would have increased tension in these dynamic plants and caused the change process to break down (source unknown).
well-publicized case at Ford Motor Corporation, for example, the old accounts payable process involved three functions: purchasing, inventory and account payable, which participated in the process serially with many intermediate steps and sequential flow of paper documents. With direct access to a shared database, the three functions now participate in the reengineered process in a parallel fashion. The reengineered process achieved a 75% reduction in the workforce required, from 500 to only 125 (see Fig. 1). 12

While shared computing resources can enable process change through reducing physical coupling, the enhancement of information coupling is primarily enabled by the application of telecommunication technologies such as a local area network and a variety of office systems products under the rubric of "groupware". Application of these technologies may greatly improve communication and collaboration between different functions involved in a business process. 13

Currently, a number of emerging information technologies, including workflow software and the popular CAD/CAM systems, hold great promise in providing this shared environment for effective team work. With the application of workflow systems, not only may different processing steps be performed in parallel on the same document or product design, but many "unnecessary" steps can also be detected and eliminated in the attempt to analyze and automate a process, thus reducing physical coupling. In addition, collaboration among those involved in the workflow may be significantly enhanced. When the popular CAD/CAM systems are tied to a global communication network, the creation of this environment can be a powerful enabler of process change. 14

6.3. Enabler set 2: Organizational

Major improvements in performance are obtained by reengineering cross-functional processes. Merely automating or augmenting existing procedures, however, do not hold much promise since these procedures involve many "vertical" movements of information and approvals within various functional areas, which tend to slow down the process tremendously. To facilitate cross-functional cooperation, traditional organization structure based on functional specialization can be modified through such organizational (structure) enablers as cross-functional teams, case managers and process generalists. In many cases, these structural enablers provide a powerful means of complementing the IT enablers discussed above to successfully institute reengineering.

The use of cross-functional teams has played a central role in many reengineering efforts. These teams enable functional interfaces and parallel design activities. Such team-based structures can improve coordination between functional components of a process and facilitate concurrent engineering when applied to the task of new product development. Coupled with telecommunication technologies,

12 The application of imaging technology has also turned many serial processes into parallel ones. At Bank One, the processing of loan applications can be performed using the digitized image of the application which may be accessed by several officers directly in a parallel fashion. When one officer attempts to verify the applicant's employment status, another will do credit scoring at the same time, while a third officer can perform credit inquiry. Thus, innovative application of shared computing resources such as imaging and common databases can be a powerful enabler for process change leading to the reduction of physical coupling for processes (Teng et al., 1994).

13 At Hewlett-Packard, for example, the sales process underwent significant change as 135 sales representatives began to use laptop computers to retrieve up-to-date inventory information from the corporate database during customer meetings. In addition, they can now use the portable computers to communicate with their peers and superiors, enabling frequent exchange of sales intelligence among the salespersons, as well as timely dissemination of corporate directives pertaining to promotion, pricing and discounting. The results showed that time spent in meetings decreased by 46%, and travel time was cut by 13%. Meanwhile, time spent with customers increased by 27% and sales rose by 10% (Berger et al., 1987).

14 The new product development at Texas Instruments illustrates the benefits of this change. The company's global network and advanced computing resources enable design teams in different countries to sustain a high level of collaboration, while permitting them to work on different parts of the design directly without sequential flow of documents. As a result, the development cycle time for various products decreased substantially. The time needed to develop a calculator, for example, declined by 20% soon after design drawings began to be sent electronically in 1989, and a further decrease of 17% has been achieved since then (Magnet, 1992).
these teams can collaborate asynchronously in remote locations. 15

Another structural enabler for reengineering is the establishment of a case manager or a process generalist for a cross-functional process who has access to the latest status information on a given transaction and serves as the single contact point for customers. While case managers coordinate work performed by many functional specialists, process generalists actually perform their work and eliminate the need for the specialists altogether. Given proper safeguards against frauds, this may mean the ultimate in efficient “cross-functional” coordination, as there are no longer separate functions to coordinate. 16

The creation of both case managers and process generalists is a powerful organizational innovation that can prove particularly useful in organizations with complex processes for bringing products and services to the customer. The inefficient interfaces between functions in these processes and the lack of

an overall process perspective can result in poor responsiveness to customers. If the information requirements of the diverse functional components of these processes can be effectively integrated through shared computing resources, then case managers can be supported with a powerful front-end interface. 17

It is critical that for true reengineering to occur, both IT and organizational enablers have to be accompanied by corresponding changes in human resource systems. In other words, with empowered teams and case managers, reward systems should be based on competence and process performance rather than efficiency of performing a predefined job description or position in the hierarchy. External customer-oriented performance-based measures are required in order for teams to think beyond their functions. Data collection efforts that support these performance measures rather than the specific information demands of traditional functional areas are needed. With the spread of work teams and the realignment of performance objectives, it becomes necessary to return decision-making power to the point where the problem occurs. This means employee empowerment without waiting for “vertical” layers of approval, which were the basis of the old functional structure and internal performance objectives. 18

7. Reality bites: The seven myths of reengineering

The popular press has propagated the “hype” of reengineering with little research to back it up. The legendary exploits of Ford, MBL, Cigna and a host of other companies have reinforced the myth that reengineering is the solution to organizational pathologies. This might be true, but only in some

15 At Modicon Inc., a maker of automation-control equipment in Massachusetts, product development is no longer the sole responsibility of the engineering function. In the past, manufacturing would not get involved in this process until the design was brought into the factory, when their suggestions on the design changes become very costly. Now, a team of 15 managers from engineering, manufacturing, marketing, sales and finance routinely work together on the process. What was traditionally a serial process in both task and structure now involves cross-functional collaboration which has eliminated many unnecessary delays and costly changes, helping to bring six products to market in one-third of the time it would normally take (Byrne, 1993).

16 At Pacific Bell, for example, the use of case managers has been central to its BPR approach. Prior to reengineering, providing a customer with a Centrex telephone service took 11 jobs and more than five business days. Service representatives had to update nine or more computer systems, making frequent errors and rework, and consulting customers several times. Now, Centrex service coordinators handle all interfaces with customers. Using a computer workstation that interfaces with all nine systems, they can now provide the service usually in the same day (Davenport and Kohri, 1994).

At IBM Credit, the financing service division within IBM, a single generalist is now performing credit checking, pricing and other activities previously done by four different specialists in processing a customer’s loan request. This arrangement has reduced the application turnaround time from six days to just four hours. With no additional workforce, the redesigned process is able to handle 100 times as many applications as before (Hammer and Champy, 1993).

17 The single greatest advantage reengineering has afforded Eastman Kodak is a consistent source of information, which enables each person involved in a project to know precisely how their work impacts others on the team (King, 1993).

18 At Cheseborough-Pond Inc., for example, factory line workers can now routinely scan on-line information on sales and stock availability to adjust the production schedules. Previously, these scheduling decisions were made by their managers on the basis of sales forecasts rather than actual sales data (Treetee, 1994).
cases, only sometimes, only under certain conditions, and only in certain types of firms. 19

Few companies that embark on the path of BPR and fail are discussed in the media. Many of the tenets of reengineering are being questioned, even by those who pioneered the concept. This evolution of classical reengineering, as described earlier, can be summarized in terms of seven myths.

Myth 1. “Reengineering is a radical one-time approach” is changing as many firms are not willing to invest the money and time to implement change from a “clean slate.” Also, some firms are finding that continuous improvement through stewardship of processes may be more beneficial in the long run. Others are distinguishing between clean-slate design which is not particularly expensive and clean-slate implementation (given the realities of the existing slate). 20

Myth 2. “Reengineering involves breakthrough performance gains” is being challenged as benchmarking and measurement of these gains can prove elusive. In many cases, more moderate gains that are consistent with the organizational culture and orientation define success. 21

Myth 3. “Reengineering enables change primarily through IT” is being moderated by the numerous organizational innovations (some of which are described above) involving people, jobs, skills and structures that facilitate process-oriented behaviors.

Many of these innovations do not involve or require IT. 22

Myth 4. “Reengineering should focus on cross-functional core business processes” is fine, but many piecemeal improvements within functions can also add up to significant change and have proven very successful. 23

Myth 5. “Reengineering enhances individual capacities through empowerment and teams” is all well and good but many process-change projects are being defended based on cost objectives achieved through downsizing with few opportunities for retraining. 24

Myth 6. “Reengineering can use a standardized set of methods touted by armies of consultants” is

19 A Gateway management consulting survey in 1993 revealed that only 44% of survey respondents from the manufacturing sector were considering or implementing BPR, as opposed to 52% of insurance executives. Also, according to interviews with 350 executives conducted by Cambridge, MA based Arthur D. Little in 1994, only 16% say that they are fully satisfied with their efforts (Anonymous, 1993).

20 American Express had two warring factions—the TQM and continuous improvement supporters and the reengineering enthusiasts. They “wallowed in debate” until executives realized that the war was producing few victors. The matter was resolved by a senior executive in charge of reengineering who redefined reengineering using Baldrige award (i.e. quality) terminology (Caldwell, 1994).

21 US West Inc. spent $290 million on a customer-service reengineering project in 1994. But the reengineering effort did not proceed as fast or as well as expected. Frustration over the project has prompted the departure of several top information systems (IS) executives, and a complete overhaul of the company’s 5000 person organization (King, 1995).

22 It is important to note that while IT is a critical enabler of most reengineering endeavors, BPR can be accomplished without IT playing a pivotal role. For instance, Hughes Space and Communication (HSC), a division of Hughes Aircraft Company, instituted a proposal in 1993 to reduce costs and eliminate non-value-added activities from its production processes. Changes aimed at internal cycle time reduction were implemented, even though they contradicted the most basic management principles in the business of high-tech, low-volume manufacturing. A radical change in manufacturing strategy and the sincere involvement of dedicated individuals and teams were needed to implement these changes. Manufacturing costs in HSC’s government electronic business unit were cut in half, cycle times were reduced ten-fold, in-process quality improved by 50%, and asset productivity increased by 250%. IT played a limited role in these efforts (Roby, 1995).

23 At DuPont, a newer culture is being instilled. Employees are judged on how well they lead efforts to improve quality, cost, competitiveness and responsiveness to their business units. At GE Power Systems, a $6.8 billion unit that makes generating equipment, changes in production methods suggested by employees cut inventory carrying charges by over $90 million per year (Wreden, 1994).

24 McKesson Water Products Co.’s reengineering effort helped the $250 million bottled water distributor cut $7 million in fixed costs and reduce its accounting department by 150 people. But it did not help sales or revenue. The company is now moving to becoming more customer oriented—rethinking work not eliminating jobs (Bartholomew and Caldwell, 1995).
being questioned—given that no standardized approach exists to date. Also, the notion of one single approach to organizational change (i.e., reengineering, quality, restructuring, etc.) is growing out of favor. Different organizational contexts are increasingly being recognized as critical to change decisions and subsequent success. 25

Myth 7. “Reengineering must be conducted from the top down” is being challenged since often detailed understanding of process design resides with people who do the work. Also, some bottom-up process change initiatives with strong inputs from line workers have proven successful. In some cases, tremendous resistance to new work designs has occurred when people do not want their jobs defined by someone else. 26

8. The future of reengineering

The future of reengineering, or process change as the concept evolves, is difficult to evaluate without considering the current business trends. A global economy has mandated greater operational effectiveness and efficiency, and imposed tremendous pressures for cost reductions. These pressures have cut across different segments of the economy, and greatly impacted the operations of service and manufacturing firms. Unfortunately, many corporations have responded by performing major workforce reductions under the aegis of reengineering. Such efforts are not strategically driven, and lead to firms losing vital components of the workforce that will make them creative and productive in the long run. Such a response compromises future competitiveness and is doomed to fail, as is also being documented for a large proportion of unsuccessful “reengineering” projects.

So where does that leave us? As is typical with all learning cycles, the initial hype is being tempered with reality. After the glorification of the concept, to the backlash of reengineering failures, we are now entering a phase where there is a more contingent notion of reengineering. As illustrated in the myths above, process change could be radical or incremental, it could be top-down or bottom-up, it may or may not involve IT, and so on. In other words, there is yet one more myth, the myth of reengineering’s sustainability. Perhaps only some of the original concepts will sustain themselves through the next decade, possibly through cycles of newer terminology and “fads.” As of now, it seems that the strong positions of “radical change”, “core processes”, “top-down”, “breakthrough performance”, etc. are giving way to the reality that there is more than one way of conducting change. Incremental and continuous approaches with bottom-up involvement within functions might be appropriate for some companies and not for others. Classical reengineering might be appropriate for others. While these approaches (e.g. TQM and reengineering) were diverging just a couple of years ago, they now seem to be converging.

Even Michael Hammer, in his latest book, Beyond Reengineering (Hammer, 1996), admits that he erred in his assertion that reengineering should be radical. This throw-it-out-and-start-all-over-again flavor was what caused excitement among managers around the world. However, Hammer now asserts that “radical” is not as important as “process” in the conduct of this endeavor. By bringing processes to the forefront, reengineering caused managers to take a lateral rather than vertical view of organizations—obviating many prescriptions in management textbooks and challenging the fundamental nature of work. Therefore, perhaps process change is the key sustainable management concept here, with organiza-

25 Texas Instruments Inc. was forced to launch its own training program when management could not find an easy way to train staff in the methodologies and techniques of reengineering its semiconductor operations. An internal think-tank was formed to develop a reengineering methodology that would enable staff to design new business processes. Since 1992, the think-tank has trained more than 1000 employees. This has proved especially helpful since only a handful of organizations offer advanced coursework for companies that already have some first-hand reengineering experience (Goff, 1995).

26 General Safety Corporation makes millions of seat belts every year for Cadillac, Buick, Pontiac and Oldsmobile. The company eliminated and replaced several assembly lines with individual workstations where employees can perform multiple tasks—improving efficiency, saving floor space, and allowing for smaller inventories. Moreover, workers helped redesign their own jobs, permitting a dozen or so to move to new positions. Double-digit improvements in productivity have been realized. Also, GS’s big breakthrough has been giving workers flexibility and unprecedented authority to decide how to do their work (Anonymous, 1994).
tional success dependent upon how well this change is implemented and accepted, and the process of change itself imbued and institutionalized. Perhaps, another sustainable notion is that of "process management" which involves the planning, structuring, and evaluation of business processes. Firms should engage in process management and apply a multitude of methods to gather information, redesign (perhaps radically followed by incrementally) and assess their processes. This portfolio of change programs could include some high risk/reward programs and some low risk/reward ones. One thing is certain, that reengineering is inter-disciplinary and should transcend functional boundaries. Integrated thinking about organizations is necessary, and any parochial perspective will only encourage organizational resistance to change. It will also locally optimize the process rather than enable a global optimum for the organizational, and in many cases the inter-organizational unit.

9. Concluding remarks

In this tutorial, we have reviewed reengineering as it has evolved from its original conception, studied the fundamental components of reengineering as distinguished from other change programs, examined its logic, studied a generic reengineering methodology, and evaluated its technological and organizational enablers. We then proceeded to challenge some of the fundamental components of reengineering, leading to a recognition that the future of this concept is perhaps (a) less in its radical nature, and more in the need to make organizations more process centric rather than task or function centric, and (b) in the ability of organizations to learn how best to implement change which involves people and social structures that resist change. For (a), the challenge is to recognize the process as an organizational unit, and to manage its change effectively. For (b), the challenge is even more daunting, and that is to change while avoiding imposition of change.

Process centering ((a) above) is not merely structural change, even though structural implications can be profound. It is challenging a century of corporate theology by thinking of processes as the unit that all people in the organization have to serve. Processes are concerned with results, not jobs. Processes involve multiple people working toward these results. Customers are key. And integration and coordination, particularly with today's Internet and Intranet technologies among others, could be critical in achieving results. In light of (b) above, the question is: how do you sell the idea of major change to the employees of the organization, and get them to "buy into" the strategic changes that must be undertaken for the firm to survive and prosper. For example, outsourcing of those activities that do not contribute to core competencies or technologies to other firms who can perform them better, may be a legitimate outcome of a good reengineering effort. It would lead to workforce reduction, but only with the purpose of making the firm leaner and more responsive. Time-based competition and the creation of "agile" corporations may not even be possible without such changes in workforce size and composition. As emphasis shifts towards greater knowledge component in value creation, process reengineering may perhaps be the only way to avoid skill obsolescence of employees and encourage horizontal career paths. The extent to which top-level management can sell such a vision of change and its impact on the employees will determine whether the reengineering phenomenon fulfils its true potential, or is merely relegated to the sidelines as another panacea and buzzword of the 1990s. The good news is in the success stories of corporations like Intel and 3M that are successfully undertaking these challenges.

10. Additional reading

Information for this tutorial has been synthesized and adapted from a wide variety of sources. Interested readers may refer to the sources below if they would like additional information on the topics covered. The type of information obtained in each source is briefly summarized.

10.1. Classic readings on reengineering concepts

These readings are written by the people who brought the notion of reengineering to the forefront. They cover fundamental concepts of reengineering, problems with traditional hierarchies, organizational
and technological enablers, and general guidelines for reengineering.

Davenport (1993)
Davenport and Short (1990)
Hall et al. (1993)
Hammer (1990)
Hammer and Champy (1993)
Hammer and Santon (1994)
Special Issue (1993)

10.2. Reengineering and IT

These readings examine the role of IT in transforming business processes and organizations. The impact of shared resources and telecommunication technologies on a process framework are discussed in more depth in Teng et al. (1994).

Malone and Rockart (1991)
Parker (1996)
Rockart and Short (1991)
Scott Morton (1991)
Teng et al. (1994)
Venkatraman (1994)
Zarroff (1988)

10.3. Methods for reengineering

These readings examine reengineering methodologies and illustrate their application. A number of tools and techniques for documenting and changing processes are also described. For instance, some of the methodological material in this tutorial is adapted from Manganelli and Klein (1994), which provides an excellent description of RapidRe, a reengineering methodology. Also, Mayer et al. (1995) provides a comprehensive view of IDEF modeling tools.

Harrison and Pratt (1993)
Ketinger et al. (1995)
Manganelli and Klein (1994)
Mayer et al. (1995)
Morris and Brandon (1993)

10.4. Reengineering and case management

This paper describes how organizational structural enablers like case managers and teams can facilitate reengineering and improve organizational effectiveness.

Davenport and Nohria (1994)

10.5. Reengineering and change management

These readings emphasize the "people" and structural aspects of change and how it can be effectively accomplished. Champy's new book discusses reengineering of managerial as opposed to operational processes.

Bartlett and Ghoshal (1995)
Champy (1995)
Cooper and Markus (1995)
Fitzgerald (1988)
Grover et al. (1995)
Hutt et al. (1995)
Kotter (1995)
Likert et al. (1987)
Lowenthal (1994)
Nadler and Tushman (1990)
Nevis et al. (1995)
Teng et al. (1996)

10.6. Case studies on reengineering

These readings illustrate in some depth how reengineering is conducted at various enterprises.

Cases at Harvard Business School on reengineering

Caron et al. (1994)
Housel et al. (1993)

10.7. Changes in the reengineering concept

These readings examine how the concept of reengineering is evolving. Sustainable aspects of reengineering are discussed.

Davenport (1995)
Davenport and Stoddard (1994)
Hammer (1996)

10.8. Reengineering anecdotes

The following list represents the sources for the examples of reengineering in the tutorial.

Allen and Nafius (1993)
Bartholomew and Caldwell (1995)
Berger et al. (1987)
Boudette (1990)
Byrne (1993)
Caldwell (1994)
Cole et al. (1993)  
Davenport and Nohria (1994)  
Davenport and Short (1990)  
Goff (1995)  
Greising (1994)  
Hammer and Champy (1993)  
King (1993, 1995)  
Maglitta (1994)  
Magnet (1992)  
Malone and Rockart (1991)  
Manganelli and Klein (1994)  
Parker (1993)  
Roby (1995)  
Stewart (1992)  
Teng et al. (1994)  
Troece (1994)  
Wreden (1994)  
Zairi and Sinclair (1995)  

References