# CHAPTER 62

# Process Design and Reengineering

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## 1. INTRODUCTION

Process design and process reengineering have received increased attention over the last decade as companies, responding to increased competition, have struggled to become more customer focused and price competitive. There has been substantial debate over precise definitions of process, business process, and process reengineering (Love et al. 1998a). There is a desire to arrive at a uniform set of definitions so that the case studies can be effectively evaluated. Aside from the debate over labels, process design and reengineering (PDR) has offered companies new ways of assessing their operations and most importantly, improving them by large orders of magnitude. While simple in concept, PDR has proven difficult to implement successfully. Some possible reasons are:

- It is not so much a scientific theory as it is a paradigm (Weicher et al. 1995).
- It "is a messy, complex process which requires strong leadership, the application of special skills and methodologies, and an ongoing commitment to process improvement" (Caudle 1995).
- Because companies and processes are different, seemingly similar PDR projects are vastly different in execution (Caudle 1995).
- It is not "universally applicable" (Coombs and Hull 1997).

However, the benefits are lucrative, and therefore companies will continue to attempt to reengineer their processes.

### 1.1. Definitions

A *process* may be defined as a "sequence of pre-defined activities executed to achieve a pre-specified type or range of outcomes" (Lee and Dale 1998) or a "sequence of activities, which are performed across time and place" (Bal 1998). It is a set of activities that transform a set of inputs into a set of outputs. Furthermore, a process may be classified as "(1) the sort that starts when necessary and finished some time in the future; or (2) the sort that is constantly running" (Bal 1998).

A *business process* is "a collection of related, structured activities—a chain of events—that produces a specific service or product for a particular customer or customers" (Caudle 1995). They may be classified as "mission or external customer-facing processes, support processes, and management processes" (Caudle 1995). There are also two critical characteristics of a business process: (1) it has external or internal customers, and (2) it crosses organizational boundaries (Malhotra 1998). A representative illustration of a business process is shown in Figure 1. Note that it spans across functions and that it has internal and external customers.

*Business process redesign* and *business process reengineering* are synonymous with PDR. The terms were introduced, respectively, by Davenport and Short (1990) and Hammer (1990). Each refers to "a systematic, disciplined approach for achieving dramatic, measurable performance improvements by fundamentally reexamining, rethinking, and redesigning the processes that an organization uses

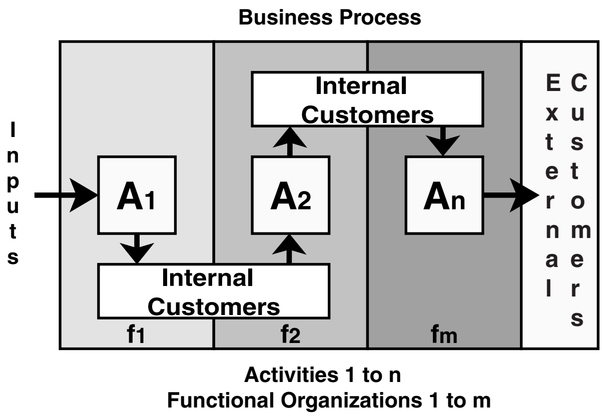


**Figure 1** Business Process.

to carry out its mission'' (GAO 1995). Since that time, several additional definitions have been contributed by various authors. Because of the multiple definitions in circulation, it has been suggested that ''the reengineering label appears simply to be related to the notion of taking an organization apart and putting it back together again, more efficiently, less expensively and with fewer personnel'' (Buchanan 1998). While this statement is essentially correct, it oversimplifies the activity and challenges it involves as well as the results realized. To illustrate the different thoughts involved with PDR, consider Figure 1. Before PDR, if a person were queried about the processes present in the company, he or she would invariably answer along the lines of f1, f2, or marketing, sales, and production. Note that these are descriptions of functions within the organization and not necessarily processes. Reengineered processes are usually described in terms of the beginning and end states—for example, purchasing, which is not really a process but a function within the organization. The process would be aptly described as ''requisition to delivery.'' The difference may seem trivial, but as a starting point for PDR it forces thought towards the activities taking place between the endpoints.

In summary, the following characteristic definition regarding redesign or reengineering emerges: ''[PDR] focuses on business process, adoption of information technology, taking fundamental analysis and radical redesign, and aims to achieve dramatic improvement in a short time delivery'' (Choi and Chan 1997). It has been contrasted with TQM in that, while both center on the concept of improvement, PDR stresses radical improvement in a short time while TQM relies on incremental improvement over an indefinite period (Jarrar and Aspinwall 1999).

Finally, business process management (BPM) is the natural resultant of PDR. While some definitions include PDR as a subset of BPM, it is obvious that if processes have been radically altered, the method of managing them must be altered as well, including performance metrics, monitoring, training, and, in some cases, the organizational structure itself (Pritchard and Armistead 1999). To this end, BPM is defined as ''a systematic, structured approach to analyze, improve, control and manage processes with the aim of improving the quality of products and services'' (Lee and Dale 1998).

## 1.2. Assumptions

The fundamental assumptions underlying PDR are (Biazzo 1998):

1. The organization is a collection of processes that can be reengineered ''scientifically'' and systematically.
2. The nature of change is revolutionary and consists of:
   - The passage from functional units to process teams
   - A move from simple tasks to multidimensional work
   - Changes in power relations towards worker empowerment
   - Change from a ''bureaucratic'' culture to one based on customer satisfaction
   - Changes in managerial behavior from supervisors to trainers
3. Planning for this change is top-down.

## 1.3. Steps

There are a variety of opinions regarding the actual steps involved in process reengineering. A typical outline of the phases is listed below. It represents a consensus view from a survey of practitioners (Kettinger et al. 1997).

1. Envision:
   - Establish management commitment and vision.
   - Discover reengineering opportunities.
   - Identify information technology (IT) levers.
   - Select process.
2. Initiate:
   - Inform stakeholders.
   - Organize reengineering teams.
   - Conduct project planning.
   - Determine external process customer requirements.
   - Set performance goals.
3. Diagnose:
   - Document existing process.
   - Analyze existing process.

4. Redesign:
   • Define and analyze new process concepts.
   • Create prototype and detailed design of a new process.
   • Design human resource structure.
   • Analyze and design information systems (IS).
5. Reconstruct:
   • Reorganize.
   • Implement.
   • Train users.
   • Process cut-over.
6. Evaluate:
   • Evaluate process performance.
   • Link to continuous improvement programs.

There are critical aspects to each of the phases as well as the elements represented within. These will be discussed in the implementation section of this chapter. The six-phase process represents a logical approach to a reengineering project and is illustrated in Figure 2.

Deceptively simple, this framework implies that PDR is simply a matter of going through a sequence of steps. However, beneath this framework lies the question of how to implement the process of change. In that respect, PDR ‘‘still remains a mystery with few rules and methods to guide firms through their endeavor’’ (Crowe and Rolfes 1998). There is a great deal to be learned from the experience of others, but that experience must be continually evaluated against the culture of the firm that is considering reengineering.

Finally, the following general observations may be made about reengineering (Caudle 1995):

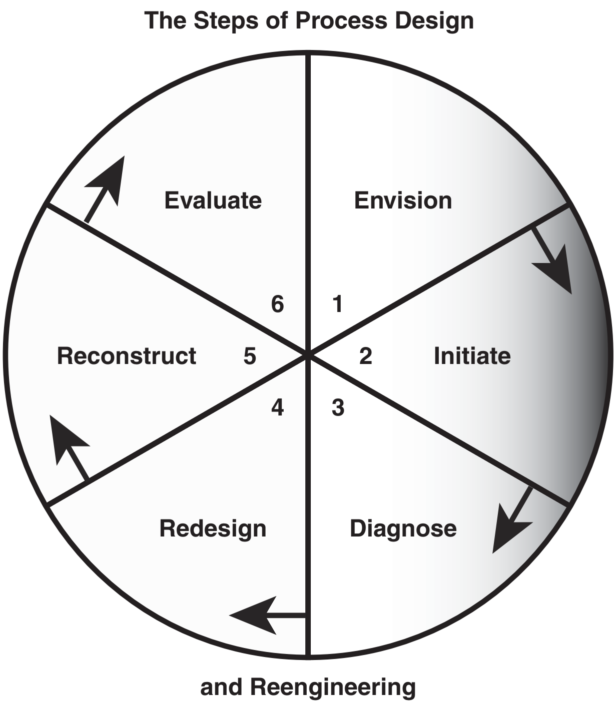


**Figure 2** The Steps of Process Design and Reengineering.

1. Be aggressive about ambitions.
2. Recognize that while a lot can be done within single departments and agencies, a lot more can be accomplished through cross-departmental integration of effort.
3. Get the policy—which in private enterprise equals strategy—clear at the top.
4. Finally, always keep in mind the hidden reefs of politics.
5. Get it done fast.

# 2. THE EVOLUTION OF PDR

## 2.1. Backdrop

A variety of factors led companies to begin to experiment with changes that eventually developed into the process reengineering paradigm. Half of the Fortune 500 companies listed 20 years ago are not on that list today. The missing ones failed to see the future in terms of customer needs, evolving technology impacts, and competition (Dickie 1995). Most, if not all, were based on the management and operational structure that developed at the beginning of the twentieth century and thus had been developed for companies in stable, expanding marketplaces.

That structure performed remarkably well through the first two-thirds of the century. Unfortunately, task-oriented work required the development of functional hierarchies for supervision and control in the workplace. As the hierarchies grew, a silo mentality grew as well. Management focused on the performance of their particular function alone, making it difficult or impossible to include internal and external customers into the decision-making process. Also, efforts directed at suboptimizing the performance of a function often had little effect on the performance of the entire system. Increased competition forced companies to improve their productivity, but that effort was frustrated by the very organizational structures that once worked so well (Lucier and Torsilieri 1999). Figure 3 illustrates the inherent problems with the hierarchical structure. Note that the communication barriers that form between the functional organizations and that optimization attempts are performed vertically and do not necessarily enhance the product flow. Furthermore, as the hierarchy grows, the command-and-control nature inherent to the organization means that the distance between the decision maker and the decision point increases.

The pyramid hierarchical organization had been rendered invalid or inoperable in most cases (Love et al. 1998a). The division of labor no longer worked either (Lucier and Torsilieri 1999). TQM programs, which helped companies rediscover the customer, also introduced an incremental change paradigm, which likewise was "no longer considered to be adequate for acquiring a competitive advantage in the marketplace" (Love et al. 1998a). The internal workings of a company had to be redefined.

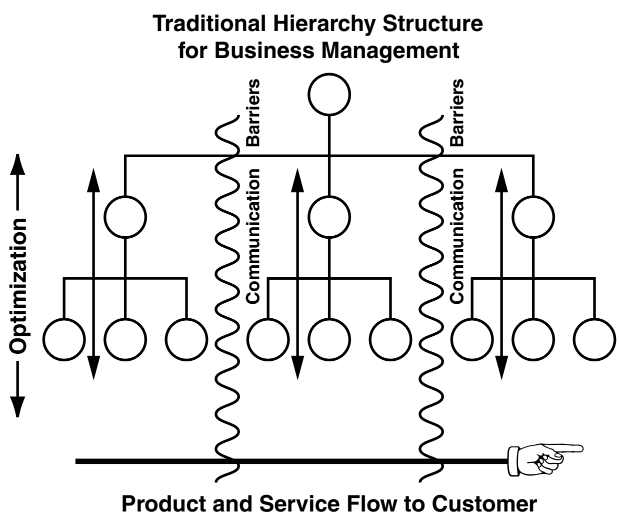


**Figure 3** Hierarchical Organization Schematic.

There is now a ‘‘perceived linkage between strategy and organizational structures’’ (Coombs and Hull 1997). The advent of the concept of a business process has permitted companies to examine how they do their work, what they do, and why they do it. ‘‘Critical business processes are the basic means to support a company’s strategic objectives according to set priorities’’ (Dervitsiotis 1999). The new process focus facilitates improvements that allow businesses to determine which activities are value-adding ones (Guimaraes and Bond 1996).

### 2.2. Implementation

The concept of process reengineering went mainstream in 1993 when Michael Hammer and James Champy’s *Reengineering the Corporation* was published. The concept was eagerly embraced because it offered breakthrough changes in performance. Process reengineering held promise because it encompassed three previously unconnected components: information technology, business processes, and a greenfield or blank sheet approach to change (Davenport 1996). While none of these components was new, there were inherent dangers in using them individually. These are shown in Figure 4.

The information technology piece allowed companies to imagine previously impossible scenarios of executing work. This, in concert with a process view of work, formed the foundation for the improvement of process reengineering. The last component, which is sometimes referred to as the blank sheet concept of change, promised that there would be no legacy components from an old system unless they were critical to the new process. In theory, designers would be able to design it right the first time and overcome the inertia of status quo. Figure 5 illustrates the results of using these components in tandem.

### 2.3. Postimplementation

As companies began to implement process reengineering programs and data were gathered, it became apparent that breakthrough performance gains were more elusive than previously thought. Estimates of failed ‘‘process reengineering’’ programs range anywhere from 50–70%. The failures were not merely isolated to flat responses in productivity. One of the direct consequences of a reengineered process without an increase in market demand is surplus labor. Displaced workers soon began to be referred to as ‘‘reengineered’’ workers. By 1996, process reengineering had come under attack as a damaging fad with ‘‘ruthless objectives and unclear methodology’’ (Buchanan 1998). Debate continues, and four main lines of thought have emerged. The prophets continue to recommend process reengineering in its original form. The disciples strive to achieve the gains of classical reengineering with more practical implementation strategies. The revisionists declare the shortcomings of classical process reengineering to be a lack of human focus and thus try to reengineer around those shortcomings. The last group, the skeptics, attack the concepts and methodology entirely (Buchanan 1998).

### 2.4. Failure Reasons

Several possible reasons for the high failure rate of process reengineering have been discussed in the literature. Harrington proposes five (Harrington 1998a):

1. The methodology was misused and the reported results were misleading.
2. Process reengineering’s negative impact on the organization was poorly defined and not considered in its implementation package.
3. The creative part of process reengineering was not understood.
4. The cycle time from start of project to reaping results was too long.

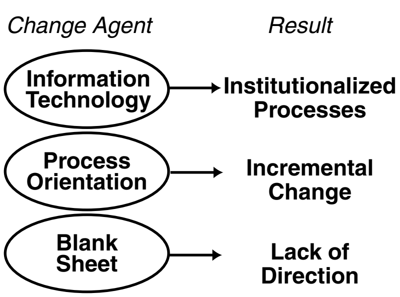


**Figure 4** The Components of Reengineering: Separate.

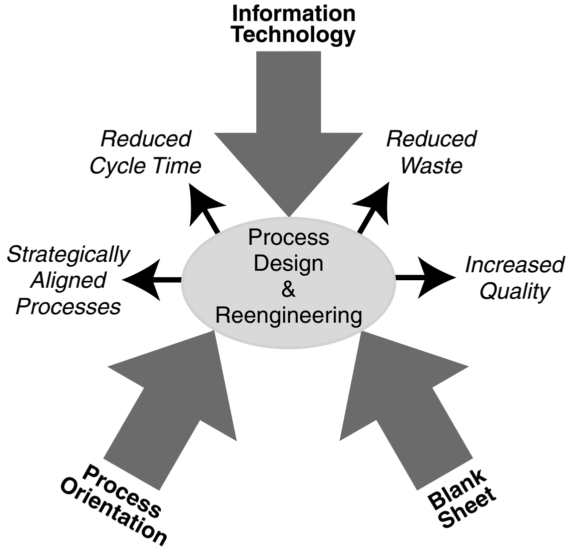


**Figure 5** The Components of Reengineering: Together.

5. It produced too good a result—the methodology failed to consider anything other than performance in developing alternatives.

Another factor that contributes to less-than-desired results in process reengineering is that newly engineered processes are often implemented in traditional functional management structures (Love et al. 1998a). This can create conflict within the system (Lucier and Torsilieri 1999)—or worse, the process can revert to its old state via work-arounds (Fisher 1997). The functional management paradigm must change along with the process. The blank sheet approach has also been criticized in that it can create impractical solutions that conflict with organizational priorities (Buchanan 1998). Apparently not all of the linkage to the old process is negative. There are times when certain aspects of a given process exist for economic, political, or other good reasons, none of which may be obvious to the casual observer. These and other negative dimensions of process reengineering are changing the methodology by which it is done. The process of PDR continues to evolve as experience is gained (GAO 1995).

## 2.5. The Second Wave

Due in large part to the shortcomings of the original attempts at reengineering, the concept of the second wave of reengineering has developed. The companies in this wave will benefit from the experience of those who participated in the first wave. This wave will focus on ''growing the top line rather than cutting costs'' (Dickie 1995). Figure 6 illustrates this trend graphically. It has three basic principles (Moeller et al. 1996):

1. Enhance the value for cost to the customer. Rather than reengineering in order to cut or maintain the cost to the customer, attempt to increase the value to the customer.
2. Realign the processes and business systems for growth. While classical reengineering produced short-term optimization in terms of costs, the second wave will make assessments in terms of the short and long term.
3. Refocus on the soft side of capabilities development. Management vision and strategy must be transformed to reflect the values of the second wave. Measurement and reward systems will need to be revisited to ensure that they promote growth. Training and management development investments will increase, and human resource processes will need modification.

## 2.6. State of the Art

It appears that reengineering is poised to make a comeback (Bartholomew 1999). This wave will have the wealth of experience of the first wave to draw upon. As mentioned above, it will have significantly different goals and will attempt to shore up the weaknesses of previous attempts. While

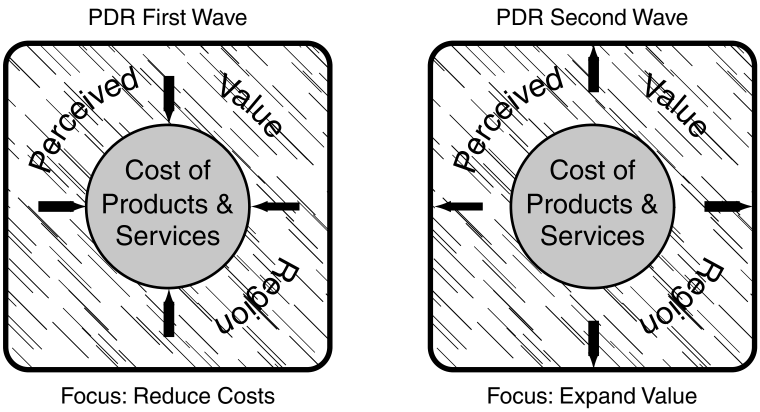


**Figure 6** PDR: First to Second Wave.

IT was one of the major components of the first wave, more focus will be applied to change management in the second wave (Guha et al. 1997). The surplus problem associated with the implementation of PDR's original form drove fear into, rather than out of, the organization. As a result, people are less willing to put their heart and soul into a project that could very well cost them their jobs. As a remedy to this, some firms have implemented policies to protect personnel from layoff (Caudle 1995). The effectiveness of measures such as these remains to be seen, but the very fact that they are being attempted underscores the potential value PDR holds for companies.

## 3. TOOLS FOR REENGINEERING

A variety of tools are available to aid in reengineering efforts. The benefits that reengineering tools provide range from process visualization and analysis to process costing to competitive analysis. When selecting reengineering tools, it is best to give consideration to those tools that are easy to learn and easy to use. If a tool requires a long learning period, its value may be diminished. When comparing tools, proportionally discount the value of a given tool relative to the time required to learn to use it. Obtain reference data from other users about a given tool and its features. Also, consider the in-house training aspects. The rest of the reengineering team must be able to learn to use the tool effectively as well (Manganelli and Klein 1994).

A reengineering tool should have at least one of the following characteristics:

1. It must be usable by the reengineering team.
2. It must provide a return on investment (ROI).
3. It must aid in clarifying the vision.
4. It must tie top-level corporate goals to subsystem goals.
5. It must integrate into the existing infrastructure.

Reengineering tools should perform at least one of the following tasks (Roberts 1994):

1. Recording or data structuring
2. Decision support
3. Process flow diagramming
4. Flow path determination
5. Process measure determination
6. Path optimization
7. Modeling
8. Simulating
9. What-if analysis
10. Constraint isolation
11. Reporting/plotting
12. Planning/tracking

Reengineering tools include benchmarking, modeling and analysis tools, simulation, and activity-based costing.

### 3.1. Benchmarking

Benchmarking is defined as ". . . the search for the best practices that will lead to superior performance of a company . . . and [that will] allow a manager to compare his or her function's performance to the performance of the same function in other companies" (Camp 1989). The desired result of a benchmarking effort is a comparison to external but similar measures of system performance, such as quality and cost and productivity (Grover et al. 1995).

Typical benchmarking steps are:

1. Determine objectives and define the scope of the benchmark study.
2. Gain support from within the organization.
3. Select a benchmarking approach to use.
4. Determine who the benchmarking partners are.
5. Retrieve benchmark data via research, surveys, and benchmarking visits.
6. Using the results, determine the necessary practices or principles that are absent within the current system.
7. Choose the principles or practices to implement.
8. Implement.

There are four broad categories of benchmarks that provide the most valuable insight into the performance of a company: business results, cycle time, quality assurance, and asset. Business results are typically financial ratios, cycle time deals with task completion, quality assurance deals with customer-related measures, and asset benchmarks range from inventory turns to human asset measures (Schwartz, 1998).

The information necessary for benchmarking may be found in public domain, technical papers, and panel discussions, as well as, information exchange (benchmarking partnership). A benchmarking partnership allows each party to gather information about the other with the goal of creating better processes. Previous benchmarking studies of related industries, libraries, conferences, databases and suppliers are also key opportunities for gathering information for benchmarking (Stork 2000).

### 3.2. Modeling and Analysis Tools

Modeling tools allow the process to be diagrammed. Process modeling is crucial because it depicts the business, the relationships, and the flow of information. With this information, the impact or potential ripple effect of changes can be determined (Morris and Brandon 1993). In process modeling, activities and their connecting links are labeled and assigned to all necessary levels (Roberts 1994). Modeling tool-selection issues are methodology, alternative views, form of input, simulation, and standardization. Process modeling may be done with flowcharts, tree diagrams, fishbone diagrams, hierarchy charts, computer-simulated models, and mathematical models. One of the most popular methods is flowcharting. Flowcharts graphically illustrate the steps of an activity. Descriptive symbols are used for each step and arrows indicate the flow. The flowcharting steps are:

1. Define steps and sequence.
2. Identify all relationships and decisions.
3. Draw straight-line representation of all work steps.

Process analysis tools are used to enter, view, and track the process inputs. These tools, like modeling tools, must show different views of the results. Most process analysis tools are packaged with modeling tools. Process analysis tool selection considerations are basically the same as those of modeling tools. Typically, process modeling and analysis tools: (Yu and Wright 1997):

1. Provide system visualization through system diagrams
2. Are PC based
3. Are easy to learn to use and scalable
4. Provide analysis and performance measures of static system
5. Provide modeling of dynamic behaviors of system

### 3.3. Simulation

Simulation tools, while not specifically designed for PDR, provide additional methods to analyze the dynamic nature processes. "Fundamental to the re-engineering effort is the ability to simulate the changes that are being proposed'' (Morris and Brandon 1993). Simulation is dynamic process modeling. Simulation allows the user to predict the behavior of a system under certain circumstances without actually building the system. Simulation is just an approximation of the physical system, but it allows changes to be rapidly incorporated and tested under a variety of conditions. Through computer simulation, process fluctuations, optimal settings, and the effect of various inputs may be determined. Basic simulation inputs are task time, resources, and demand, while the outputs are cost, throughput, cycle time, utilization, and bottlenecks (Petrozzo and Stepper 1994).

### 3.4. Activity-Based Costing (ABC)

The need of reengineering teams for accurate information regarding the consumption of resources by processes led to renewed interest in activity-based costing (ABC). ABC is an accounting methodology in which costs are assigned to activities, as opposed to products or services. ABC more accurately distributes the applicable costs to those products and services that consume them. ''The precision of ABC is useful in establishing the true costs of the component and the compound process outputs'' (Grover et al. 1995). ABC provides necessary information as to where the money is going or where certain costs lie. An example of activity-based costing is shown in Figure 7.

In ABC, costs are assigned to activities based on resource consumption. Cost is then assigned to elements such as products or customers. This information provides the foundation for deciding on issues such as outsourcing and corporate spending. Often, when traditional accounting systems are used for costing, cost is overallocated to high-volume production and underallocated to low-volume production on a per-unit basis. To portray the value of proposed systems over current ones accurately, it is imperative that accurate methods be employed for costing.

ABC is used by reengineering teams to perform cost-benefit analysis on proposed systems including the segmented delivery of products and services. ABC will determine the cost and viability of a product/process/system, both before and after reengineering. The steps for ABC are (Maluso 1997):

1. Use a process map to identify the major business processes and key activities of the organization.
2. Attach the cost to these key activities. Financial data may be gathered from existing data, including information on labor and capital equipment expenses, budget, general ledger, and supplier invoices.
3. Link activities to processes and identify the cost drivers.
4. Summarize the total costs for each process.
5. Do this as well for the reengineering process.

## 4. IMPLEMENTATION

### 4.1. Preplanning

As mentioned in the introduction, a framework exists for conducting PDR activities. Not explicitly noted in the outline is the necessity for training and planning before any large-scale reengineering effort begins. Ultimately, the entire organization will be required to think in terms of process. This is one of the primary challenges of process management (Lee 1996). For reengineering to flow smoothly in the planning and design stages, management and staff will need to know its function,

| Traditional | | ABC | | |
|---|---|---|---|---|
| Wages | $150.00 | | # Units | |
| Supplies | $ 50.00 | Clean Bathroom | 6 | $150.00 |
| Insurance | $ 30.24 | Vacuum | 3 | $21.00 |
| Transportation | $ 10.00 | Dust | 3 | $15.00 |
| | | Change Linen | 3 | $12.00 |
| Profit | $ 59.76 | Empty Trash | 6 | $12.00 |
| | | Clean Kitchen | 3 | $90.00 |
| Cost | $300.00 | | | $300.00 |

**Figure 7** ABC vs. Traditional Costing.

its implications, and how it fits into the scope of improvement efforts (Caudle 1995). The vision for change must be articulated over and over again. Management and staff will need to be educated in the concepts of process and reengineering. The design team should thoroughly understand the design process (Feather 1998) and be cognizant of its linkage with organizational structure (Gappmaier 1997). Spending time, effort, and money on educating people before beginning the reengineering process pays back by eliminating misunderstanding and indecision.

For most companies, the process view of work is a new one (Lee 1996). Before making the decision to reengineer along process lines, management must be firmly committed to that end as well as the necessary changes it entails (Caudle 1995). They must have in mind a target performance level that they wish the new structure to achieve (Love et al. 1998a) and a measurement system must be in place in order to let them know whether the reengineered system is, in fact, performing to expectations. This requires that employees be educated on performance measures and uses (Caudle 1995).

Lastly, management must assess the culture of the organization and determine its propensity towards change. This has proven to be a major stumbling block in a majority of the reported PDR efforts (Corrigan 1997). It is apparent from the literature that some organizational cultures have a greater capacity for accepting and processing change than others (Love et al. 1998b). Organizations that have the ability to accept change readily have been referred to as learning organizations and are "characterized by the ability to adapt and improve, to build internal and external knowledge, and to achieve higher levels of learning that may be critical to successful [PDR]" (Guha 1997). Communicating early and throughout can help overcome resistance to change (Feather 1998) and is viewed as a critical success factor to PDR projects (Andrews 1996a).

Figure 8 provides a summary of the steps involved in preplanning.

## 4.2. Envision

### *4.2.1. Establish Management Commitment and Vision*

A prerequisite to successful implementation of a BPR project is unequivocal support from upper management (Ho 1999). The vision must be communicated to and embraced by the entire organization, but this communication is especially important in dealing with midlevel and functional managers who are affected by the changes (Guha 1997). As the implications of change are realized, risk aversion and uncertainty can develop, creating an atmosphere where less than optimal solutions are developed (Morris et al. 1999). In these cases, management's commitment is tested. The case for change and the vision of the future state must be coupled with a strategy for achieving change. Successful organizations require and practice hands-on senior management's aggressive ownership of process improvement through personal responsibility, involvement, and decision making. Most often this is seen in the use of executive committees, steering groups, and the assignment of process owners (Caudle 1995).

### *4.2.2. Discover Reengineering Opportunities*

The breakthrough improvements available from reengineering can come in one of two forms. Reengineering a process can take away the inefficiencies present in terms of cost and time to process but leave the general value adding sequences the same. This is accomplished by removing organizational

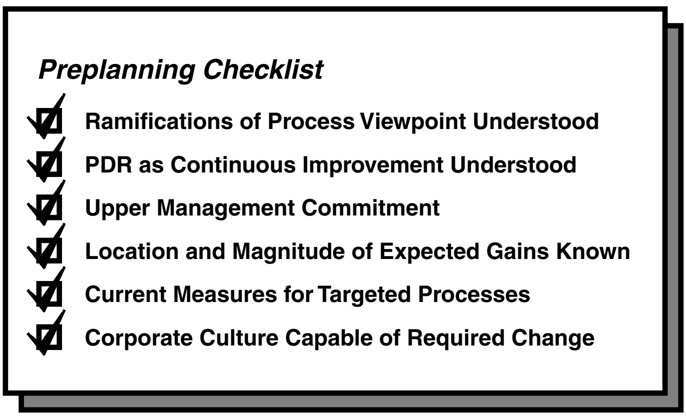


**Figure 8** Preplanning Step Checklist.

issues, archaic rules, and legacy procedures that are counterproductive to the overall goal (Bartholomew 1999). Companies gain from examining their processes in this way, but not every instance will yield the same "opportunity for dramatic breakthrough" (Bal 1998). The most significant improvements are realized when entirely new processes are developed for bringing existing products and services to customers. The following three characteristics describe efforts of this sort (Feather 1998):

1. New opportunities in markets, products, and services where value is created in the business process are discovered and exploited.
2. New ways of thinking about the process using design principles and process benchmarks are utilized.
3. Innovative core processes that encourage people to behave differently are developed.

Being creative is one of the most demanding aspects of PDR. One of the features of PDR that has allowed companies to be more creative with their process thoughts is information technology.

### *4.2.3. Identify Information Technology Levers*

The strategic importance of information was always known, but until recent times nothing could be done to exploit it. Modern technology, however, has served to erase the geographic barriers that once stood in the way of information flow. Likewise, it has permitted the lag time that existed between information collection, data entry, and report to be reduced. Real-time information processing is a reality. Realizing this in process design permits processes to be developed that behave and perform drastically different than their predecessors. "Successful [PDR] involves the coalescence of 'IT' and business best practice, whereby IT plays a supportive, but not always commanding role that is linked to the business case for [PDR]" (Guha et al. 1997).

The specific roles played by IT in PDR are many and vary from case to case. It may be used to enhance communications at the customer interface through electronic data interchange, software training systems, and distributed product/service specifications and performance data. It can facilitate the distribution of information across and outside of the organization through centralized, shared databases, networks, and wireless communications. It enables companies to provide services economically at remote locations with expert systems. The rapid increase in computing power has allowed companies to eliminate the batch mentality altogether. No longer are strategic decisions made in concentrated groups at specific points in time. Plans can update in real time and data models can provide revised forecasts instantly. Accurate snapshots concerning production and distribution data are accessible with electronic tracking and identification. Customer orders can be monitored and accurate lead times can be quoted. Internal organizational performance can be monitored as well. All of these innovations typically provide the backbone of redesigned processes. They all have the common trait of providing the necessary information to the necessary destination in a usable form at the time it is needed.

While it is generally agreed that IT is the enabler for paradigm shifts required for reengineering, it has also been pointed out that its misuse can prevent PDR projects from succeeding by institutionalizing old concepts and processes (Hammer and Champy 1993). Simply automating the old systems is not reengineering and should not be confused with it. The fundamental concept in successfully utilizing IT in PDR is that it is used to change the way things are currently done or even eliminate the need for them, not merely to optimize them.

### *4.2.4. Select the Process*

There is much to be said about selecting a process for reengineering. To achieve the greatest gain, processes selected for reengineering must have strategic importance. "A fact often overlooked is that processes exist to support specific strategic goals considered vital for survival and success" (Dervitsiotis 1999). Companies should begin by evaluating their business strategy and then determining which processes are critical to the strategy (Bartholomew 1999). Failure to do this has been cited as a contributor to implementation failure (Peltu et al. 1996). All processes must be reviewed so that the interdependence among them may be fully understood (Guha et al. 1997).

Figure 9 provides a summary of the envision step activities.

## 4.3. Initiate

### *4.3.1. Inform Stakeholders*

Everyone associated with the process must be informed of the need for and intent of the reengineering effort. Management, customers, suppliers, employees, and labor unions are included in this group. The sharing of information from the outset decreases the possibility of misunderstanding and increases the possibility of success (Lee 1996). From the customer's perspective, this enhances the channels of communication regarding their service level needs. From the employee's perspective, this

***Envision Step Checklist***

- ☑ **Upper Management Support Fostered Through**
  - **Process Ownership**
  - **Steering Committee Representation**
- ☑ **Overall Vision Articulated and Embraced by Organization**
  - **Competitive Forces**
  - **Desire to be "Best" in Class**
  - **Customer Demand**
- ☑ **Reengineering Opportunities Isolated Through**
  - **Process Benchmarks**
  - **Focus on/Development of Value-Added Services**
- ☑ **Information Technology Levers**
  - **Networked, Centralized Databases**
  - **Realtime Communication**
  - **Automation**
- ☑ **Potential Processes Selected and Ranked from among**
  - **Processes that Serve/Impact External Customers**
  - **Strategy Supporting Processes**

**Figure 9** Envision Step Checklist.

allows them the opportunity to buy into the process as opposed to having predetermined solutions forced upon them.

### *4.3.2. Organize Reengineering Teams*

The actual size and number of teams for a given project may vary. It is essential that the team members, especially the design members, be trained to work in a team environment. The members responsible for design must also have a background of experience or training in process design, as well as some knowledge of the current technologies available for use in reengineered processes. This is where consultants are sometimes used to add missing skills to a team. Some process reengineering experts recommend that the PDR team be split into two parts: a design team and an execution team (Weicher et al. 1995). Others have suggested that the team be split into a documentation and an analysis team. The purpose of splitting the documentation and analysis functions is to maintain objectivity in the analysis. It has been reported that documenting ''as-is'' conditions causes the practitioners to become emotionally invested in the current system, thereby reducing their ability to see opportunities for improvement (Andrews 1996b). Separating the two neutralizes the effects of this phenomenon.

### *4.3.3. Conduct Project Planning*

The challenges facing the project planning team are similar to those facing other large-scale project management teams. Beginning and end dates must be established. Aggressive but realistic timeframes must be incorporated. Levels of measurable accomplishment must be defined for all stages. Individuals should be made accountable for specific outcomes (Feather 1998). Resources must be made available to the team as well as the project. These may be financial but will most certainly take the form of personnel and time. Inadequate staffing at critical points in the project can lead to unsuccessful attempts at reengineering (Ho 1999). Scope creep is an ever-present danger in any project. This is doubly so in reengineering efforts. Processes are complex and difficult to visualize (Bal 1998). This can lead to the inclusion of unrelated processes into the design of the process of interest. The hazard that is peculiar to reengineering efforts is cultural change. In some cases, the process concept is so new that time to assimilate and understand the concept must be factored in. In all cases, the change itself must ''proceed at a pace which can be accommodated by the organization'' (Peltu et al. 1996).

### *4.3.4. Determine External Process Customer Requirements*

There are a variety of methods for determining customer requirements. Quality function deployment models use the voice of the customer as an integral component in process design. Focus groups and benchmark data also provide valuable insight. Placing customer representatives on the actual process design team has been done with great success. Surveys can also derive information from customers. The informal nature of surveys, however, places them in a ''general'' data-gathering category.

### *4.3.5. Set Performance Goals*

Performance goals are frequently established using the gap between the customer requirements and the performance of the current process. Likewise, benchmarking data can provide the performance goals for the new process. The metrics depend on the process being measured, but the firm can use measures that it is already familiar with. Examples include queue time, flow days, and backlog. A key element is making sure the measures cross-over from the old process to the new (Caudle 1995). It is imperative to be able to gauge the performance of the new process against the old.

Figure 10 summarizes the initiate step activity.

## 4.4. Diagnose

### *4.4.1. Document Existing Process*

Many PDR proponents suggest skipping this step because they believe it limits the vision of the design team and that there is nothing to be gained from such a task. The problem of limited vision was addressed previously. The amount of information to be gained from this step is addressed here. Practitioners have suggested that only if the processes are laid out end to end do the impacts of the process become apparent (Lee 1996). It is equally important to document the cross-departmental aspects of the process (Fisher 1997). The dynamic relationships inherent in the process yield the greatest understanding of the organization and how it functions (Ould 1997). The level of technology used for this process depends on the team itself. There are a variety of examples in the literature, ranging from ''sticky notes'' on the wall to data flow diagrams to sophisticated computer programs (Bartholomew 1999). Essentially, all of these methods describe the task, the owner and customers, and the information inputs and outputs.

***Initiate Step Checklist***

- ☑ **All Impacted Internal/External Entities Informed**
- ☑ **Reengineering Teams Formed**
  - **Trained or Experienced in TEAM Environment**
  - **Trained or Experienced in Process Design**
  - **Knowledge of Current Technological Capabilities**
  - **Plan for Handling Documentation vs. Analysis**
- ☑ **Project Planned**
  - **Scope**
  - **Duration**
  - **Resources**
  - **Implementation**
- ☑ **Customer Voice**
  - **Integrate Customer into Design and Analysis Functions**
- ☑ **Performance Goals Established**
  - **Current Metrics and Values Captured**
  - **Specific Improvements Quantified**

**Figure 10** Initiate Step Checklist.

#### *4.4.2. Analyze Existing Process*

Two aspects of the existing process must be assessed. The first is the performance of the process as compared to customer expectations (the external performance of the process). The second is in regard to the value added/non-value added components of the current process (the internal performance of the process). This step is critical in the delivery of bottom-line benefits (Ho 1999). Much insight into the external performance of the system was gained in the initiate stage, where the performance goals were set. In the internal performance evaluation, tasks are evaluated as value adding or non-value adding. Using manufacturing terms, tasks such as transportation and rework are non-value adding, while machining and painting are value adding. What is found typically "is that 65% to 70% of the tasks are non-value [tasks]. At the lowest level of detail, you find massive amounts of waste" (Bartholomew 1999).

Figure 11 summarizes the activity involved with the diagnose step.

### 4.5. Redesign

#### *4.5.1. Define and Analyze New Process Concepts*

Much has been said about the missing element in the reengineering prescription. Establishing the future-state solution is a difficult, creative process. Hammer and Champy (1993) point this out when they say, "[T]here are no seven or ten step procedures that will mechanically produce a radical new process design." They do, however, provide some characteristics of reengineered processes: (1) several jobs are combined into one, (2) workers make decisions, (3) the steps in the process are performed in a natural order, (4) processes have multiple versions, (5) work is performed where it makes the most sense, (6) checks and controls are reduced, (7) reconciliation is minimized, (8) hybrid centralized/decentralized operations are prevalent. Insight is gained in the reengineering effort when the conventional thinking is challenged. Policies and rules, whether written or not, can often be the reason a process exists in its current form (Bartholomew 1999).

#### *4.5.2. Prototype and Detailed Design of New Process*

The detailed design effort can take several months. The new process will require new skills, thinking, and behavior from those who are a part of it. The process will not exist in isolation. It will exist among all of the other processes within a company, demanding input and providing output. Many of the inputs come from shared resources. "When designing a process there needs to be both technical and social inputs, as well as the infrastructure and architecture to support the process. If incremental, dramatic or step performance improvements are sought then the technical and social inputs must have a degree of congruence" (Love et al. 1998a).

Whenever possible, new process concepts, if not the entire process, should be prototyped first. There is valuable information to be gained from such activity (Feather 1998). Even in the event that the process does not perform as expected, lessons gained from the experience can be applied to the next iteration of prototype design.

***Diagnose Step Checklist***

- ☑ **Tools Selected for Data Capture and Modeling**
- ☑ **Document "As-Is" Process**
  - **Physical Form**
  - **Information Form**
  - **Performance Measures**
- ☑ **Analyze Current Process**
  - **Correlate Output Weakness with Internal Characteristics**
  - **Summarize Value-Added vs. Non Value-Added Content**
  - **Challenge Assumptions Implicit in Current Form**
  - **Review Product/Service Characteristics**

**Figure 11** Diagnose Step Checklist.

#### *4.5.3. Design Human Resource Structure*

"Among the variety of reasons for the failure of reengineering processes, one of the most serious is not providing a human-performance system to support each and every performer in the organization" (Fisher 1997). "The significant factor that determines the performance of an organization is its people" (Frohman 1997). To get the people to work in concert with the new process, there is a need to develop and link reward and recognition systems to the process (Pritchard and Armistead 1999). The adage "Show me how I'm measured and I'll show you how I perform" still holds true. In order to drive home the message of process, these systems must be altered to support the new process. This may involve organizational changes (Love et al. 1998a).

Figure 12 summarizes the activities involved with the redesign step.

### 4.6. Reconstruct

#### *4.6.1. Reorganize*

One of the most hotly debated topics concerning reengineering is the surplus of employees that it can create. In a majority of the case studies, the employees no longer required by the new processes were laid off. Although cost cutting was arguably not one of the original primary goals of reengineering, it quickly became one as companies realized they had a surplus. Research performed since then indicates that wholesale workforce reduction may not be the correct choice of action for the following reasons:

- Stock market gains realized after the cuts are usually not long lasting (Harrington 1998b).
- Productivity either stayed the same or deteriorated after the layoff (Guimaraes and Bond 1996).
- The company cuts its capacity for future growth (Weicher et al. 1995).
- Those who are left are fearful and uncooperative (Strassman 1994).

Some companies have gone to the other extreme, guaranteeing at the outset of a reengineering effort that no jobs will be lost (Willets 1996). This is done in an effort to solidify the cooperation necessary

***Redesign Step Checklist***

☑ **New Process Concepts**
- **Jobs Combined Where Possible (Training & IT)**
- **More Decision Authority at Job**
- **Processes Capable of Custom Configurations**
- **Automated Error Checking/Review**
- **Wait Times Minimized**

☑ **Detail Design**
- **Impact on Other Processes Assessed**
- **Impact on Organization(s) Assessed**
- **Customer Requirements Satisfied**
- **Concepts Tested**
- **Education/Training Needs Identified**
- **Cost/Benefit Analysis**

☑ **Human Resource Structure Identified**
- **Workforce Estimates**
- **Process Measures and Human Performance Measures Linked**
- **Management Structures Aligned with Process**

**Figure 12** Redesign Step Checklist.

for genuine innovation within the workplace. While this may not be the correct answer either, there is one guiding principle to use in the event that the surplus must be reduced: Don't eliminate the full number of surplus employees provided by estimates. First, no amount of planning can accurately gauge the headcount required by the new process (Macdonald 1998). Second, the knowledge and skill lost in the workforce reduction will naturally impede the performance of the new process until those skills are reacquired. This aspect is rarely modeled in workforce estimates.

### *4.6.2. Implement*

Implementation problems are bound to develop. The interactions are too numerous and the complexity too great for this not to be expected. While it is impossible to foresee every issue that might develop, case history does provide some clues (Guimaraes and Bond 1996). Examples include (1) communication barriers between functional areas, (2) lack of leadership, (3) strategies being formed outside the company's ability to implement, (4) difficulty having the changes accepted by the employees affected, (5) unexpected enormity of the undertaking and disruption to the company, (6) difficulty balancing the incentives of traditional performance measures against what really needs to be done, (7) faltering of some projects because nervous corporate backers pull out at the first sign of difficulty, (8) executives many times being unsure whether it is a worthwhile undertaking, (9) information systems infrastructure in most large organizations being a major impediment to achieving immediate benefits, (10) the tough problems of elimination of positions and worker anxiety over losing jobs, (11) management reluctance to commit resources, (12) major training costs to make the transition and management frustration with slow results.

### *4.6.3. Train Users*

As mentioned previously, process thinking is new to most organizations. Users must be given the opportunity to learn the implications of process thought. They must reorient their thinking towards the customer and learn to evaluate their job in terms of how it supports the customer. Also, the process may introduce new technologies and skill requirements. The users must be given the opportunity to acquire the tools necessary to perform their new job.

Figure 13 summarizes the activities involved with the reconstruct step.

## 4.7. Evaluate

### *4.7.1. Evaluate Process Performance*

The evaluation of the new process will be in accordance with the process measures developed previously. If new measures were developed, they should have been implemented while the old process was still operating. It is important to realize that early measures of the new process may not reflect its true performance potential. This can be due to the disruption caused by cut-over. In the case where new measures are being used, it may reflect the need to refine the measures.

***Reconstruct Step Checklist***

☑ **Reorganization**
- **Plan for Dealing with Potential Surplus of Labor**
- **Plan for Dealing with Customer Implications of Elimination/Reduction of Products/Services**

☑ **Implementation**
- **Management Requirements**
- **Disruption Estimated and Anticipated**

☑ **Training**
- **Specific Skills Related to New Process**
- **General Process Thinking**

**Figure 13** Reconstruct Step Checklist.

Several successful organizations are now creating assessment programs to evaluate process-improvement successes and failures and share lessons learned (Caudle 1995). This would be a system of measuring the reengineering process itself, enabling the organization to develop its own set of best practices and spread the knowledge across the organization.

#### *4.7.2. Link to Continuous Improvement Programs*

In the final analysis, PDR is an improvement program within the realm of TQM. As such, companies are compelled to constantly reevaluate themselves and their performance. The TQM framework makes the customer the absolute measure of performance and PDR makes the process the item to be measured. Including PDR in the category of improvement tools implies that the reengineering process is not a static, one-time event but rather another improvement tool that can be used as necessary to improve the products of an organization.

Figure 14 summarizes the evaluation step activities.

## 5. CASE STUDIES

### 5.1. Corning Asahi Video (Manganelli and Klein 1994)

Corning Asahi Video (CAV) is a business unit of Corning, Inc., and manufactures glass for televisions. The company had performed in the red during the period from 1987–1991. Customer dissatisfaction was high relating to lead times and order placement, and management was frustrated with its information system because the inventory and order status information was difficult to extract. To rectify this situation, the company set out to reengineer its order-fulfillment process. The overall goals of the project were to:

- Restore profitability by improving efficiency within the process
- Minimize rework and error
- Strengthen internal communications and provide process-wide access to customer information.

Initially, a cross-functional team was formed to redesign the process and implement the changes. The customer service manager was appointed as the head of this team. Customer interviews and internal studies were conducted to target inefficiencies and determine their root causes. The resulting information was shared with all of the 1200 employees at CAV.

Several changes were implemented based on study findings. To incorporate new technology, CAV adopted an existing Corning process for new product development that facilitated communication with top management to support the identification, selection, and adoption of process supporting technology. Disjointed systems of information flow were replaced with an integrated database-driven system. Customer service was consolidated into one location, and the role of customer service was expanded to allow better service. Throughout the project, employees were kept apprised of the project effort.

The project was completed in 15 months at a price of $570,000. As a result of reengineering, rework and cost overruns have been reduced by $1.6 million annually. Per order costs have decreased by 75%. Personnel costs have been reduced by $400,000 annually. Order fulfillment time has been reduced by 50% from 180 days to 90 days. The number of tasks required in the order-fulfillment process was reduced from 250 steps to 9.

***Evaluation Step Checklist***

☑ **Process Measurement at Inception and Evaluated Frequently**

☑ **Continuous Improvement Links**

- **Review Other Processes**
- **Periodic Benchmarks of New Process**

**Figure 14** Evaluation Step Checklist.

### 5.2. Uarco, Inc. (Weston 1997)

Uarco, Inc., is a company that prints purchase order forms and other business documents. It has 14 manufacturing and service call centers located across the United States. Its annual revenues are in excess of $550 million. In 1995, the company analyzed its processes and identified $100 million in costs associated with its order-fulfillment process. This was its single most expensive process. Upon closer inspection, it found unexpected costs in their order management systems. An exorbitant amount of time was spent taking and quoting orders. Since each job is, in effect, a custom solution, each aspect of the customer specification had to be looked up to determine the cost component in order to deliver the quote to the customer. The specification components were contained in a 1000-page manual that had to be consulted for each order and change order. The process could take hours. Updating the manual was time consuming as well because change pages had to be mailed to all of the service outlets. It was determined that 60–80% of the sales force's time was spent administering orders.

As part of the solution, older mainframe units with isolated PCs were replaced with Windows NT servers and networked PCs. Client/server software was purchased along with application software that allowed the company to share database information among its geographically dispersed offices. Shared, replicated databases provided a more streamlined, real-time update process. Electronically stored specifications allowed quicker access and thus quicker order fulfillment.

With the new systems in place, the cost to provide 213,500 quotes annually has decreased from $16 million to $10 million. The capital investment by the company was $21 million. Their net profits have increased by $25 million annually. Much of the change is due to the changed nature of the workload of the salesperson. Under the old systems, a salesperson would spend 80% of his or her time administering orders and only 20% selling. Those figures have reversed under the new systems.

### 5.3. D2D, Ltd. (Gadd and Oakland 1995)

D2D, Ltd. is a manufacturing subsidiary of International Computers Ltd. (ICL), a systems integrator. In the mid-1980s, the IT industry underwent dramatic change. At the pinnacle of mainframe manufacturing, ICL had profit margins of over 80%. By 1994, margins were 3–4% (typical of the industry). Material costs typically accounted for 80% of the cost of finished goods. Traditional performance measures were no longer significant.

ICL faced the prospect of outsourcing its manufacturing operations in order to remain competitive. Instead, they chose to improve their operations with investments in automation, JIT, flexible assembly cells, MRP systems, EDI, and surface-mount lines. These investments enabled the company to remain competitive but put it in an under-capacity condition. Restructuring within ICL and establishing outside strategic alliances reduced the demand for goods from the manufacturing division. This provided the foundation for radical change within D2D. Extra capacity for ICL's manufacturing subsidiary, D2D, would have to be found outside the company. Given P&L accountability, the subsidiary had to transform itself from the inward-looking one it had always been into a market-led and customer-facing organization.

As a starting point, the division determined its core competencies and added a sales and marketing function. It also determined other services that were intrinsic to its culture that it could market. To help in the transformation, a customer care training program was developed. All existing employees went through the program, and all subsequent new employees now do as well. The investment in technology, particularly the manufacturing technology, enabled a flatter infrastructure with a more empowered workforce—one that was more devoted to the customer. EDI provided a connection among D2D, its vendors, and its customers that, because of its prevention-based nature, reduced order and material mistakes, thus making the supply chain more efficient. EDI created a process view that is pulled by the customer.

BPR has become an integral part of the culture at D2D. It has provided the perspective necessary to undertake the bold changes that were necessary because of the change in charter. By 1993, D2D's profits were 57% higher than in 1992. The cost associated with defects had dropped significantly as a percent of revenue. By 1995, non-ICL revenue was 50% of total revenue.

### 5.4. Fortune 500 Insurance Company (Feather 1998)

A Fortune 500 insurance company decided to reengineer its death claims process in order to reduce cycle time, cost, and customer dissatisfaction. Initially, a design team was formed and customer and process data were analyzed. Two important discoveries were made in this phase that would have significant bearing on the final solutions that were developed. First, a mismatch was discovered between the actual cycle time of the claim process and the cycle time deemed acceptable to the customer. Second, because of the inability of the company to provide customer data visibility to all units of the company, many opportunities—totaling hundreds of millions of dollars—were not being captured by the company.

In preparation for the reengineering effort, a design team was selected and trained in reengineering design principles. A four-stage methodology was introduced to help guide them through the effort. The methodology emphasized the discovery of new opportunities to create value in business processes, new ways of thinking in terms of process, the design of innovative, value-creating business processes encouraging different behavior, and attention to implementation details. The team used simulation exercises to familiarize themselves with design principles and encourage new thought.

The design team was separated into three subteams. The first team mapped the existing workflow. The results of their work revealed a death claims process made up of 200 steps, with only 18% of those steps deemed as value added. The second team was responsible for analyzing the cycle time of the process, while the third team conducted focus groups with beneficiaries and agents. The beneficiary focus groups provided priceless information in terms of acceptable time frames for contact, as well as typical needs of clients.

The insurance company saw tremendous opportunity in what it learned. It found that when a beneficiary needs investment counsel after receiving a death claim, it would be advantageous for the company to be able to provide options to the beneficiary coincident with the time of payout, thereby increasing the probability that the assets would be retained in the insurance company's accounts. This would effectively link the payout of benefits to the reinvestment of those benefits.

The team quickly realized that they would need to bring in technology expertise. A technology team was formed to work on information flow issues that developed through redesign efforts. It was also determined that agent and claim site personnel representation on the design team would be necessary in order to make the ideas and concepts that were beginning to develop coalesce. Design options were developed in several sessions involving all of the necessary personnel and classified into three categories: workflow, organization, and technology.

With the design options in hand, the team formed into two subteams to create the new design. This was done in order to facilitate creativity. The eventual design was a consensus design between the two teams. The features of the new design were more methods available to the beneficiary to initiate a claim and the ability to segment claims between those requiring high or low administration. The most significant change in the process was the way that company viewed it. No longer was the payment of the death claim viewed as the end of the process. With the incorporation of the correct data-recording processes and technology, the payment was now viewed as a follow-up opportunity to provide reinvestment options to the beneficiaries.

The results of the effort yielded a process with 50% fewer steps. The segmenting process at the front end of the claim permitted 65% of the claims to be processed within two days. Costs associated with handling claims were reduced by 28%, and cycle time was reduced by 56%.

## 6. LESSONS LEARNED

The literature points to several areas that can be considered providing advice for future practitioners. PDR is a reasoning process applied to a highly complex set of systems to produce a process. The systems include employees, customers, equipment, policies, and strategies, to name a few. The very nature of the systems—their variability—ensures that no two PDR projects will behave in the same fashion. Small differences on the input side lead to large differences on the output side (Ferrie 1995). Because of this, PDR will never be a one-size-fits-all technique. PDR, being highly situational, will require solutions to be developed on a case-by-case basis, requiring the imagination and intellect of the entire design team, if not the entire organization. As a heuristic approach, there is no one "best" answer. However, all actions planned or deployed must be considered in regard to their impacts and outcomes.

Another key point to remember is that the scope of reengineering should be limited. Despite the title of their book, Hammer and Champy never intended that the corporation be reengineered on all fronts simultaneously. Select the strategically important processes, rank them, and focus attention on the most critical ones. Only one or two processes should be reengineered at a time (Harrington 1998).

The people issues will continue to be a part of PDR since very few "lights-out" systems require reengineering. The critical aspect here is to remember to reengineer not in spite of the human aspects of the system, but in congruence with them. The key contribution of the process comes from its people rather than its hardware or systems (Frohman 1997). The first formal definition of industrial engineering, as established by the American Institute of Industrial Engineers in 1955, recognized the inseparability of people from the systems of interest to the profession. "Successfully integrating people within a system will always be the ultimate design challenge" (Ferrie 1995).

## 7. FUTURE OUTLOOK

There are diverse opinions concerning the future of reengineering. Some feel that "knowledge management, employee empowerment, adoption of new information technology, and shared vision" will lead to greater reengineering success (Kettinger and Grover 1995). Others feel that taxonomy will improve the success rate, while still others feel that the key is the integration of organizational theory and control and MIS (Malhotra 1998). It is predicted that reengineering projects will be undertaken more often to keep up with a dynamic business environment and that success will be based upon how quickly a company seizes the moment. The reengineering project time will continue to decrease. Regardless of exactly how it will evolve, it is safe to assume that reengineering will continue to be used within organizations as a tool for improvement.

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