Chapter 2: Solutions to Exercises

Exercise 1

See section 2.1 for a detailed discussion.

Exercise 2

Section 2.1.1 describes each basic principle in detail. Grouping them into the three phases makes sense both from a logical point of view, as well as a sequential point of view.

Exercise 3

The 5-step improvement methodology in Six Sigma (DMAIC) is closely related to the three phases discussed in the Process Management framework (see section 2.2.4.) Although originally applied to selection of improvement projects, Six Sigma uses this same framework for process and product design. This framework uses principles similar to project management, such as: Definition (understanding the process), Measurement (developing and implementing measures), Analysis (providing feedback), Improvement and Control (establishing control points).

Exercise 4

The CPS model is a useful approach to deal with interface-related workflow problems. Based on the premise that a producer’s output should satisfy the customer’s requirements, the model helps identify and define the critical internal interfaces in a process, as well as the external interfaces. Taken as a chain of internal customers, the CPS model identifies the supplier, producer and customer involved at each step in the process, in order to assess the requirements and capabilities of the process at that particular point.

Exercise 5

The purpose of the exercise is to make the students go through the document distribution example and critically analyze a process. There could be many answers to the broad questions asked but the answers need to be well motivated with a clear logic.

Suggested answers include but are not limited to:

• Main managerial problems with the process
  – Coordination of activities, particularly when it comes to interactions between the internal mailing services, the print shop and Joe’s department
– Poor understanding of the process
– Joe’s lack of influence/control over mailing services and the print shop
– Lack of established process ownership recognized throughout the process

• *Do you agree with Joe’s approach*

  It is a systematic approach following the principles of process management. However, things that could be somewhat debatable include the use of control points and the choice of measurements. It should be recognized that it is a short-term solution to try to fix the process and bring it in control. Long term, the excessive control is not to recommend. A new process design seems called for.

• *Is there anything you would do differently?*

  Potential issues are for example…
  – The dealings with the print shop: more aggressive, require high priority, demand quality control of documents before leaving the print shop
  – Checking of addresses: need a better system where changes are reported automatically from the HR department

• *Potential for redesign? Plausible ideas?*

  – Should be a high potential
  – An important design enabler in this case seems to be IT.
  – Why distribute hard copies of the document? Sending it electronically, (e-mail, intranet etc.) would make both physical printing and mailing obsolete. This implies elimination of most of the problems in the current process and a considerably shorter cycle time!
Exercise 6

The technical definition of Six Sigma assumes that a process’s output follows a normal distribution with mean $\mu$, and standard deviation $\sigma$. In order for the process to be considered to meet the six sigma quality requirement, the process variability must be so small that each of the predefined specification limits for the process is at a distance of at least $6\sigma$ from the target value. Allowing for a drift of the process mean $\mu$ of $\pm 1.5\sigma$ from the target value, this corresponds to an expected number of defective outcomes of no more than 3.4 per one million observations. See Figure 2.7 for a graphical description.

![Figure 2.7](image)

**Figure 2.7** The technical definition of Six Sigma Quality as achieved when the distance between the process target value and the closest specification limit is at least 6 standard deviations (sigma), and the process mean does not deviate more than 1.5 sigma from the target value, $T$.

Exercise 7

When describing a Six Sigma initiative, it is important to stress its fierce focus on bottom line results. Its top priorities are to reduce costs and increase revenues by improving process efficiency and effectiveness, respectively. Efficiency is achieved by targeting the dimensions of variation, cycle time and yield; effectiveness is achieved by identifying and meeting customer requirements. For a more detailed explanation, see section 2.2.2 and 2.2.5.

Exercise 8

The components of the Six Sigma framework are: Define, Measure, Analyze, Improve and Control (See section 2.2.4 for a detailed discussion of each component of the DMAIC
improvement methodology). There are various similarities with the reengineering and process management frameworks. Although the Six Sigma framework was first developed for improvement project selection (see Exercise 3), it applies to process and product design. One of the keys to the success of the Six Sigma methodology is the discipline it promotes from performing each phase of the improvement methodology. Although the first one, the Define phase is sometimes omitted (it is assumed that this phase is already done when the improvement project begins), skipping any other phase undermines the discipline involved. Furthermore, each phase implements objective performance measures that are later utilized to (1) clearly communicate the effectiveness of the current effort; and (2) analyze the results of the current effort and utilize them to improve future improvement projects. If the language is undermined, then understanding is obscured.

**Exercise 9**

For a detailed discussion of the Six Sigma cost and revenue rationale refer to section 2.2.2. In a hospital or university setting, where profits are not necessarily the objective, organizations still need to satisfy customer requirements in an efficient and effective way. Six Sigma provides a framework to achieve these goals.

**Exercise 10**

See Section 2.2.2. Six Sigma uses the concepts of *dispersion*, *predictability* and *centering* to represent process variability. In general terms, large *dispersion* refers to large variation or variability in the measured process characteristics. *Predictability* implies that the process characteristics over time belong to the same statistical distributions. In other words, a predictable process is considered to be in statistical control, meaning that over time the measured characteristic belongs to the same statistical distribution, i.e., with the same mean and dispersion (often measured in terms of standard deviation). Given a process in statistical control, the dispersion refers to the width of the distribution, that is, high dispersion implies it is more likely to end up far away from the process mean. *Centering*, finally, refers to how well the mean of the process distribution is aligned with the target value. Ideally, we would like the process to be predictable and the corresponding distribution should have a low dispersion and be well centered.

The standard approach for variability reduction in Six Sigma is:

1. eliminate special cause variation to reduce the overall dispersion and bring the process into statistical control, i.e., improve the predictability,
2. reduce the dispersion of the predictable process,
3. centering the process to target.

The Six Sigma philosophy is well in line with Deming’s mantra of continuous improvements as well as Taguchi’s perception that any deviation from the process target value will cause excess costs.
The tools used in Six Sigma approaches to reduce variation are the same as in traditional quality and process control, the 7QC tools and factorial experiments. These tools will not be further explored in this book. The interested reader can turn to any basic textbook in quality control or quality management, such as Foster (2001) or Evans and Lindsay (2002).

**Cycle time and yield** are important characteristics of any process. The cycle time is the time a job spends in the process, sometimes also referred to as process or production lead-time. The process yield or productivity is the amount of output per unit of input or per unit time. Consequently, cycle time and yield can be used to describe a variety of process performance aspects including input material, equipment utilization, set up times, lead-times, capacity and productivity.

Six Sigma improvement projects focused on cycle times and yield follow the same approach as for variation, namely to gain predictability, reduce dispersion and center with target. However, when it comes to centering, the target is usually more broadly defined as to minimize cycle time and maximize yield improvement.

**Exercise 11**

The traditional roles assigned in Six Sigma are related to a martial arts system of “belt” degrees, from white to black (see section 2.2.4. under “Training”). This system makes sense from the perspective of familiarizing the entire workforce with the basic principles of the Six Sigma methodology, and requiring higher levels of knowledge and commitment from higher degrees (ranks) in the organization. Special care, however, must be placed in managing the “soft” people issues: the evolutionary change model advocates the active participation of the people involved in the change. In the revolutionary change model, however, change is imposed on the organization, and this may conflict with the roles expected from the Six Sigma approach. Although, the improvement projects are led by Six Sigma experts (black belts) the success of Six Sigma programs are contingent on the involvement and buy-in of all people in the process/organization.

**Exercise 12**

See section 2.2.4.

**Exercise 13**

See section 2.2.5 and exercise 8.

**Exercise 14**

The most cited reasons for reengineering failures are closely related to those prescribed by the Six Sigma methodology and the general principles for process management. Namely, lack of top
management support, poor understanding of the resources needed to support the new design, lack of expert guidance and motivation, neglecting people’s values and beliefs, etc.

**Exercise 15**

Six Sigma draws on ideas from both TQM programs and the reengineering movement, it could therefore be positioned somewhere between these approaches. It has sprung out of the principles for excellent quality management, but it combines these ideas with a strong focus on the bottom line and on achieving measurable results quickly. While it can be applied to drastic changes, it is basically an evolutionary change methodology.

**Exercise 16**

The process paradox refers to the decline and failure of businesses that have achieved dramatic improvements through process reforms. To avoid the process paradox, companies must get “the right processes right”.

**Exercise 17**

The criteria often used to determine when a process should be redesigned are: *dysfunction, importance and feasibility* (see section 2.3.4 for a detailed description). According to Hammer and Champy (1993), the forces that drive the need for change are the three C’s: *Customers, Competition and Change* (see section 2.3.3).

**Exercise 18**

Roberts (1994) makes the distinction between *formal* and *informal* processes. Formal processes are usually prime candidates for reengineering (see section 2.3.4.). However, since it is impossible to reengineer all formal processes at once, priorities should be established, based on three main criteria:

1. Dysfunction: which processes are in deepest trouble?
2. Importance: which processes have the greatest impact on customers?
3. Feasibility: which processes have a high likelihood to be successfully reengineered.

These criteria are very similar to the principles used by Six Sigma for prioritizing improvement projects.

**Exercise 19**

See section 2.3.5 for a detailed explanation of each framework. Each of these frameworks relates closely to the Six Sigma DMAIC approach.
**Exercise 20**

There is a close relationship established between both methodologies. First, the loop between the pilot test and the process design steps allows for continuous improvement of the process design itself. Second, Roberts explicitly identifies a continuous improvement stage to maintain the radical changes implemented through the reengineering project.

**Exercise 21**

The revolutionary model implies shaking the very foundation and structure of the organization. This strain makes the redesign effort very risky, and lack of careful management and executive support can help explain the failure of many reengineering efforts. Therefore, many companies that do not face an immediate crisis tend to use a more cautious, evolutionary implementation strategy first, creating the necessary momentum for change in the organization. The prerequisite for such a strategy to be a viable option is time. The organization must be proactive and initiate change before an imminent crisis materializes. Otherwise, there might not be time for anything but a rapid revolutionary change tactic, if the firm is to have any chance of survival.

**Exercise 22**

This question is meant to elicit creativity in the students. Maybe a brainstorming session could be organized in class to address these issues. There are no simple right-or-wrong answers, but the students should be guided to think in terms of the impact and feasibility of their ideas, and relate them to the various frameworks studied in this chapter.
Figure 2.1
Basic principles of process management.
Process authority, scope, interfaces and handoffs are determined.

**Figure 2.2**
Initialization phase.
Figure 2.3
CPS model.
Phase I: Initialization

- Assign process ownership

Phase II: Definition

- Analyze boundaries and interfaces
- Define the process

Phase III: Control

- Establish control points
- Develop and implement measures
- Perform feedback and control

- Process authority, scope, interfaces and handoffs are determined
- Workflow documentation
- Baseline for process evaluation is defined

**Figure 2.4**
Definition phase.
Phase I: Initialization
- Assign process ownership
- Analyze boundaries and interfaces

Phase II: Definition
- Define the process

Phase III: Control
- Establish control points
- Develop and implement measures
- Perform feedback and control

- Process authority, scope, interfaces and handoffs are determined
- Workflow documentation
- Baseline for process evaluation is defined
- Means and procedures for process monitoring, feedback and control are established

Figure 2.5
Control phase.
Input: Master document

Print and bind copies

Receive and sort copies

Look up address on distribution list, address envelope, insert copy and leave for mailing services

Sort and distribute

Output: Copied documents

Eligible managers

Figure 2.6
High-level flowchart of the document distribution process.
Figure 2.7
Technical definition of Six Sigma quality as achieved when the distance between the process target value and the closest specification limit is at least six standard deviations (σ), and the process mean does not deviate more than 1.5 σ from the target value, T.
Figure 2.8
Six Sigma efficiency loop.
Figure 2.9
Six Sigma cost and revenue rationale combining the efficiency and effectiveness loops.
Figure 2.10
Six Sigma framework.
Figure 2.11
Six Sigma improvement methodology DMAIC.
Figure 2.12
Radical versus incremental improvement.
Figure 2.13
Mapping of customer issues to processes.
**Figure 2.14**
Forces affecting process feasibility.
Figure 2.15
Roberts’ framework for process reengineering.
Figure 2.16
Lowenthal’s framework for process reengineering.
Figure 2.17
Cross and associates’ framework for process reengineering.
Process Management and Process Oriented Improvement Programs

Chapter 2
Overview

- Process Management and the Power of Adopting a Process view
- Six Sigma
  - Definitions
  - Cost and revenue rationale
  - Framework
  - Key success factors
- Business Process Reengineering
  - What is it?
  - Brief history
  - What processes should be reengineered, and when?
  - Suggested frameworks
- Evolutionary vs. Revolutionary Change
Process Management

- Principles of managing, controlling and improving processes
  - Workflow oriented ⇔ how jobs flow through an organization
- Important elements in managing processes
  - Process design
  - Continuous (incremental) improvement
  - Control systems
  - People management
  - Change management
- Origins in the field of quality management
  - Process control is a fundamental component
- Historically strong manufacturing focus
  - Equally valuable in services
The Power of Adopting a Process View

Weaknesses of the functional org. and division of labor paradigm

- Focus on skills and resource utilization rather than work output
- Reward systems tailored for the functional unit not the overall firm
- Group behavior and cultures fostering an “us versus them” mentality
- Decentralization ⇒ “firms within the firm” with their own agenda

Strengths of a process view

- Creates focus on work output ⇒ reduced risk for sub-optimization
- Leads to transparency of how contributions of individual workers fit into the “big picture” ⇒ encourages involvement and empowerment
- Helps break down barriers between departments
- Creates a sense of loyalty towards the process to balance the loyalties within the functional units
Principles for Successful Process Management

**Phase I: Initialization**
- Assign process ownership

**Phase II: Definition**
- Analyze boundaries & interfaces
- Define the process

**Phase III: Control**
- Establish control points
- Develop & implement measures
- Perform feedback & control

- **Process authority, scope, interfaces and handoffs are determined**
- **Workflow documentation**
- **Baseline for process evaluation is defined**
- **Means and procedures for process monitoring, feedback and control are established**
Phase I: Initialization

Objective:
- Clarify the process scope
- Determine who will take responsibility for the process

Process ownership

Need someone in charge to make things happen

Responsibilities of a process owner
- Accountability and authority for process operations and improvements
- Facilitate problem solving and make sure corrective action is taken
- Mediate between line managers with overlapping authorities

Guidelines for assigning process ownership
- Manager with most resources or most work invested in the process
- Manager that is most affected if the process fails
- Process owner must have high enough position to see how the process fits into the “big picture”, needs clout to solve functional bickering
Analyzing Process Boundaries and Interfaces

- Process Boundary defines the process entry and exit points where inputs flow in and outputs flow out
  - Provides a clear picture of the process scope
  - Defines the external interfaces

- Internal interfaces
  - Hand-off points within the process boundaries
  - Most critical where the process crosses functional or organizational borders

- Most process inefficiencies are related to insufficient interface communication (= lack of coordination)
  - Important to identify critical interfaces early on
The Customer-Producer-Supplier (CPS) model

- Useful approach for resolving interface related problems
- Applying the CPS model to all critical interfaces ⇔ adopt a view of the process as a *chain of customers*
  - Coordination achieved by understanding internal & external customers
  - Involves negotiation and agreement between all parts

```
Producer Requirements

Supplier → Input → Producer PROCESS → Output → Customer

Input Interface

Customer Requirements
```

- Producer Requirements
- Output Interface
- Input Interface
- Customer Requirements
Phase II: Definition

- Objective:
  - Understand and document the process workflow
  - Facilitate communication and understanding of process operations

Define the process

- Documentation of work content in individual activities
  - Usually in terms of verbal descriptions
    - Operating procedures or Standard Operating Procedures (SOP)
- Documentation of process flows
  - Usually a flowchart based method
    - Combination of verbal and graphical description
- Common information gathering techniques
  - Interviews with people working in the process (group or individual)
  - Analytical observation
  - Review of relevant documentation
Phase III: Control (I)

Objective:
- Establish a system for controlling the process and providing feedback to the people involved

Establish Control Points
- Control points are activities such as inspection, verification, auditing, measuring, counting...
  - Usually considered business value adding
- Without control points and a control system the only way of assessing process performance is customer feedback
  - The process ends up in a reactive mode
  - Poor quality is discovered too late
- Location of control points is determined by
  - Criticality – impact on customer satisfaction
  - Feasibility – physically and economically possible
Develop and Implement Measurements

- Involves answering the questions
  1. What is to be measured and controlled (Ex. FedEx)?
  2. What is currently measured (available data)?
  3. Can a business case be made for a new measurement system?
  4. What is the appropriate sampling method, sampling size and frequency?

- Measurements should be meaningful, accurate and timely
  - Statistical and graphical tools needed to turn data into information.

- Five measurement categories: Measures of...
  - Conformance (to given specifications)
  - Response time (lead-time, cycle time)
  - Service levels (degree of availability)
  - Repetition (frequency of recurring events such as rework)
  - Cost (Quality, PAF, internal and external failure costs)
Phase III: Control (III)

Performing Feedback and Control
- Of critical importance for stabilizing and improving the process
- Objectives of control/corrective action are
  - Regulation to maintain a certain performance level
  - Improvement aiming at reducing variability or raising the average performance level
- Feedback is an important enabler for corrective action
  - People in the process need to understand how their actions affect the overall process and its performance
  - Feedback should be performed in a constructive – not punitive – manner
- Constructive feedback
  - Makes people feel that they matter
  - Encourages involvement and commitment
Six Sigma is originally a company wide initiative at Motorola for breakthrough improvement in quality and productivity

- Launched in 1987
- Rendered Motorola the Malcom Baldridge National Quality Award 1988

The ongoing success of Six Sigma programs has attracted a growing number of prestigious firms to adopt the approach

- Ex. Ford, GE, AMEX, Honeywell, Nokia, Phillips, Samsung, J.P. Morgan, Maytag, Dupont...

- Broad definition of Six Sigma programs

  “A company wide strategic initiative for process improvement in both manufacturing and service organizations with the clear objective of reducing costs and increasing revenues”

- Fierce focus on bottom line results
Reduce the variation of every individual process to render no more than 3.4 defects per million opportunities.

Assuming the process output is normally distributed with mean $\mu$ and standard deviation $\sigma$ the distance between the target value and the closest specification limit is at least $6\sigma$ and the process mean is allowed to drift at most $1.5\sigma$ from the target.
Reducing costs by increasing process efficiency has an immediate effect on the bottom line.

To assure worker involvement, Six Sigma strives to avoid layoffs.

The Six Sigma Efficiency loop:

- **Commitment**
- **Cycle Time**
- **Reduced Costs**
- **Increased Profits**
- **Yield**
- **Variation**

**Improvement projects**

The Six Sigma Efficiency loop is designed to enhance process efficiency by focusing on minimizing variation and improving cycle time, ultimately leading to reduced costs, increased profits, and enhanced yield.
The Six Sigma Cost or Efficiency Rationale

Oriented around the dimensions of variation, cycle time & yield

Variation

Can be divided into two main types

1. Common cause or random variation
2. Special cause or non-random variation

Non-random variation

- Relatively few identifiable root causes
- First step in reducing the overall variation is to eliminate non-random variation by removing its root causes

Random variation

- The result of many different causes
- Inherent in the process and can only be affected by changing the process design
The Six Sigma Cost or Efficiency Rationale

Variation (cont.)

- Important concepts in understanding the impact of variation
  - Dispersion
  - Predictability
  - Centering

Dispersion
- Magnitude of variation in the measured process characteristics.

Predictability
- Do the measured process characteristics belong to the same probability distribution over time?
- For a predictable process the dispersion refers to the width of the pdf.

Centering
- How well the process mean is aligned with the process target value.
Variation (cont.)

Ideally the process should be predictable, with low dispersion, and well centered.

Standard approach for reducing variability in Six Sigma programs:

1. Eliminate special cause variation to reduce overall dispersion and improve predictability
2. Reduce dispersion of the predictable process
3. Center the process to the specified target

Six Sigma use traditional tools for quality and process control/analysis:

- Basic statistical tools for data analysis
- The 7 QC tools
The Six Sigma Cost or Efficiency Rationale

Cycle time and Yield

- Cycle time (lead-time, response time)
  - The time a job spends in the process
- Yield (productivity)
  - Amount of output per unit of input or per unit time
- Improvement in cycle time and yield follow the same tactic as for variation
  - Gain predictability, reduce dispersion and center to target
- The target is usually broadly defined as
  - Minimize cycle time and Maximize yield
- Six Sigma principle
  - Improvement in average cycle time and yield should not be made at the expense of increased variation
Determinants of the company’s revenues
- Sales volume closely related to market share
- Sales prices

⇒ Revenues contingent on how well the firm can satisfy the external customers’ desires

An important Six Sigma Success factor is the focus on internal and external customer requirements in every single improvement project
The Six Sigma Cost & Revenue Rationale

- Improvement projects
- Customer satisfaction
- Increased Market Share & potentially higher prices
- Reduced Costs
- Increased Revenues
- Increased Profits
- Commitment
- Variation
- Cycle Time
- Yield

- Reduced Costs
- Increased Profits
- Customer satisfaction
- Increased Market Share & potentially higher prices
- Increased Revenues
- Increased Profits
- Commitment
- Variation
- Cycle Time
- Yield

- Reduced Costs
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- Increased Profits
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- Variation
- Cycle Time
- Yield
The Six Sigma Framework

- Centered around a disciplined and quantitatively oriented improvement methodology (DMAIC)
  - Define, Measure, Analyze, Improve, Control

```
Top Management Commitment

Training

Improvement Methodology
  Define ➔ Measure ➔ Analyze ➔ Improve ➔ Control

Measurement System

Stakeholder Involvement
```
Six Sigma Success Factors

The bottom line focus and big dollar impact
  Encourages and maintains top management commitment

The emphasis on - and consistent use of - a unified and quantitative approach to process improvement
  The DMAIC methodology provides a common language so that experiences and successes can be shared through the organization
  Creates awareness that decisions should be based on factual data

The emphasis on understanding & satisfying customer needs
  Creates focus on doing the right things right
  Anecdotal information is replaced by factual data

The combination of the right projects, the right people and the right tools
  Careful selection of projects and people combined with hands on training in using statistical tools in real projects
Introduction to Reengineering

- Business Process Reengineering (BPR)
  - One of the buzzwords of the late 80’s and early 90’s
  - “…achieves drastic improvements by completely redesigning core business processes”
- BPR has been the subject of numerous articles and books; classical examples are:
BPR Success Stories and Failures

Success Stories

• Ford cuts payable headcount by 75%
• Mutual Benefit Life improves underwriting efficiency by 40%
• Xerox redesigns its order fulfillment process and improves service levels by 75-97% and cycle times by 70% with inventory savings of $500 million
• Detroit Edison reduces payment cycles for work orders by 80%

Failures

• An estimated 50-70% of all reengineering projects have failed
• Those that succeed take a long time to implement and realize
Reasons for BPR Failures

- Lack of support from senior management
- Poor understanding of the organization and the infrastructure
- Inability to deliver necessary technology
- Lack of guidance, motivation and focus
- **Fixing a process instead of changing it**
- Neglecting people’s values and beliefs
- Willingness to settle for marginal results
- Quitting too early
- Allowing existing corporate cultures and mgmt attitudes to prevent redesign
- Not assigning enough resources
- Working on too many projects at the same time
- Trying to change processes without making anyone unhappy
- Pulling back when people resist change

Etc...
What does it take to succeed with BPR?

• Hammer and Champy
  – “The role of senior management is crucial.”
• Empirical research indicates...
  – organizations which display understanding, commitment and strong executive leadership are more likely to succeed with process reengineering projects.
• Common themes in successful reengineering efforts
  1. Firms use BPR to grow business rather than retrench
  2. Firms emphasize serving customers & compete aggressively with quantity & quality of products & services
  3. Firms emphasize getting more customers, more work and more revenues instead of downsizing
Reengineering and its Relationships to Other Improvement Programs (I)

• Reengineering - what is that?
  – “The fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed” (Hammer and Champy 1993)
  – A number of similar definitions by other authors also exist

• Reengineering characteristics
  – Focus on core competencies or value adding business processes
  – The goal is to achieve dramatic improvement through rapid and radical redesign and implementation
  ⇒ Projects that yield only marginal improvement and drag out over time are failures from a reengineering perspective
### Reengineering and its Relationships to Other Improvement Programs (II)

<table>
<thead>
<tr>
<th></th>
<th>Rightsizing</th>
<th>Restructuring</th>
<th>Automation</th>
<th>TQM</th>
<th>Reengineering</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assumptions</strong></td>
<td>Staffing</td>
<td>Reporting relationships</td>
<td>Technology applications</td>
<td>Customer needs</td>
<td>Fundamental</td>
</tr>
<tr>
<td><strong>questioned</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Focus of change</strong></td>
<td>Staffing, job responsibilities</td>
<td>Organization</td>
<td>Systems</td>
<td>Bottom-up improvements</td>
<td>Radical changes</td>
</tr>
<tr>
<td><strong>Orientation</strong></td>
<td>Functional</td>
<td>Functional</td>
<td>Procedures</td>
<td>Processes</td>
<td>Processes</td>
</tr>
<tr>
<td><strong>Role of IT</strong></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><strong>Improvement goals</strong></td>
<td>Usually incremental</td>
<td>Usually incremental</td>
<td>Incremental</td>
<td>Incremental</td>
<td>Dramatic and significant</td>
</tr>
<tr>
<td><strong>Frequency</strong></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>
Relationship between Discontinuous (Radical) and Continuous Improvement

![Graph showing the relationship between discontinuous (radical) and continuous improvement. The graph includes categories for theoretical capability, statistical process control, incremental improvement, and radical improvement over time.]
Brief History of BPR (I)

- Most agree that Michael Hammer laid the foundation to the reengineering approach...
- ...But many factors influenced the birth and hype around BPR
  - The origins can be traced back to a number of successful projects undertaken by management consulting firms like McKinsey in the 80’s
  - TQM had brought the notion of process improvement onto the management agenda
  - The recession and globalization in late 1980’s and early 1990’s stimulated companies to seek new ways to improve business performance
    - Programs often aimed at increasing flexibility and responsiveness
    - Middle management under particular pressure
...But many factors influenced the birth and hype around BPR

- The Productivity Paradox (Stephen Roach)
  - Despite powerful market and service innovations related to IT and increased computer power in the 1980’s there was little evidence that IT investments improved overall productivity
  - Organizations were not able to utilize the capabilities of the new technology – Automating inefficient processes has limited impact on productivity
- Articles and books by Hammer, Davenport, Short, Champy etc. legitimized and defined the reengineering approach
  - Early success stories were heavily published in the popular press
- Many consultants/vendors launched their own versions of BPR
  - All types of change programs were labeled reengineering
  - Gave BPR a bad name
When Should a Process be Reengineered? (I)

- Three forces are driving companies towards redesign (The three C’s, Hammer & Champy, 1993)
  - **Customers**
    - are becoming increasingly more demanding
  - **Competition**
    - has intensified and is harder to predict
  - **Change**
    - in technology
    - constant pressure to improve; design new products faster
    - flexibility and ability to change fast are requirements for survival
When Should a Process be Reengineered? (II)

- Useful questions to ask (Cross et al. (1994))
  - Are customers demanding more for less?
  - Are your competitors providing more for less?
  - Can you hand-carry a job through the process much faster than the normal cycle time (ex five times faster)?
  - Have your incremental improvement efforts been stalled?
  - Have technology investments been a disappointment?
  - Are you planning to introduce radically new products/services or to serve new markets?
  - Are you in danger of becoming unprofitable?
  - Have cost-cutting programs failed to turn the ship around?
  - Are operations being merged or consolidated?
  - Are the core business processes fragmented?
What Should be Reengineered? (I)

- Processes (not organizations) are reengineered
  - Confusion arises because organizational units are well defined, processes are often not.
- Formal processes are prime candidates for reengineering
  - Formal processes are guided by written policies; informal processes are not.
  - Typically involve several departments and many employees.
  - More likely rigid and therefore more likely to be based on invalid assumptions.
What Should be Reengineered? (II)

**Screening criteria**

1. Dysfunction
   - Which processes are in deepest trouble (most broken or inefficient)?

2. Importance
   - Which processes have the greatest impact on the company’s customers?

3. Feasibility
   - Which processes are currently most likely to be successfully reengineered?
## Dysfunctional or Broken Processes

### Symptoms and diseases of broken processes

<table>
<thead>
<tr>
<th><strong>Symptom</strong></th>
<th><strong>Disease</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Extensive information exchange, data redundancy and re-keying</td>
<td>Arbitrary fragmentation of a natural process</td>
</tr>
<tr>
<td>2 Inventory, buffers and other assets</td>
<td>System slack to cope with uncertainty</td>
</tr>
<tr>
<td>3 High ratio of checking and control to value-adding</td>
<td>Fragmentation</td>
</tr>
<tr>
<td>4 Rework and (re)iteration</td>
<td>Inadequate feedback along chains</td>
</tr>
<tr>
<td>5 Complexity, exceptions and special cases</td>
<td>Accretion onto a simple base</td>
</tr>
</tbody>
</table>
Importance

- Assessed by determining issues the customers feel strongly about and identifying which processes most influence these issues.

**Market**
- Customer Issues
  - Product Cost
  - On-time Delivery
  - Product Features
  - After-sales service

**Company**
- Processes
  - Product Design
  - Order Processing
  - Procurement
  - CRM
Feasibility

- Determined by: Process Scope, Project Cost, Owner Commitment and the Strength of the Redesign Team
  - Larger projects offer potentially higher payoffs but lesser likelihood of success
The Process Paradox

- The process paradox refers to the decline and failure of businesses that have achieved dramatic improvements through process reengineering.

- To avoid getting caught in the process paradox companies must "Get the right processes right"
Suggested Framework for BPR (I)

In general, keywords for successful BPR are creativity and innovation...
...but BPR projects also need structure and discipline, preferably achieved by following a well thought-out approach.

BPR Framework due to Roberts (1994)

- Starts with a gap analysis and ends with a transition to continuous improvement.
- The gap analysis focuses on three questions:
  1. The way things should be
  2. The way things are
  3. How to reconcile the gap between 1 and 2
Robert’s Framework for BPR

Opportunity assessment → Current capability analysis

Process Design

Risk and impact assessment

Transition plan

Pilot test

Infrastructure modifications

Implementation and transition

Tracking and performance

Continuous improvement process
Suggested Framework for BPR (II)

BPR Framework due to Lowenthal (1994)

- Consists of 4 phases
  1. Preparing for change
  2. Planning for change
  3. Designing for change
  4. Evaluating change

- Phase 1 – Goals
  - Building management understanding, awareness and support for change
  - Preparing for a cultural shift and acquire employee “buy-in”

- Phase 2 – Assumption
  - Organizations need to adopt to constantly changing marketplaces

- Phase 3 - Method
  - To identify, assess, map and design
  - A framework for translating process knowledge into leaps of change

- Phase 4 – Means
  - Evaluate performance during a specified time frame
Lowenthal’s Framework for BPR

Phase I
Preparation for change

Phase II
Planning for change

Phase III
Designing change

Phase IV
Evaluating change
BPR Framework due to Cross, Feather&Lynch (1994)

1. Analysis
   - In depth understanding of market and customer requirements
   - Detailed understanding of how things are currently done
   - Where are the strengths and weaknesses compared to the competition

2. Design
   - Based on principles that fall into six categories
     1) Service Quality – relates to customer contacts
     2) Workflow – managing the flow of jobs
     3) Workspace – ergonomic factors and layout options
     4) Continuous improvement – self sustaining
     5) Workforce – people are integral to business processes
     6) Information technology

3. Implementation
   - Transforming the design into day to day operations
Cross et al’s Framework for BPR

- **Analysis Phase**
  - Customer Requirement analysis
  - Baseline analysis
  - Design specifications
  - Current process review
- **Design Phase**
  - High-level design
  - Design principles
  - Detailed design
  - Design options
  - Build in CI feedback
- **Implementation Phase**
  - Pilot new design
  - Model/validate new design
  - Transform the business

Business Process Modeling, Simulation and Design (Second Edition)
Laguna and Marklund
Revolutionary vs. Evolutionary Change

- The reengineering movement advocates radical redesign and rapid revolutionary implementation and change
- A revolutionary change tactic
  - Turns the whole organization on its head
  - Has potential to achieve order of magnitude improvements
  - Is very costly
  - Has a high risk of failure
- To reduce risks and costs of implementation many companies end up with a strategy of radical redesign and evolutionary implementation tactic
  - Implementing the feasible plans given current restrictions

⇒ Implemented process is usually a compromise between the original process and the “ideal” blueprinted process design
# Revolutionary vs. Evolutionary Change

- Elements of evolutionary and revolutionary change theories

<table>
<thead>
<tr>
<th>Element</th>
<th>Evolutionary change model</th>
<th>Revolutionary change model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>Insiders</td>
<td>Outsiders</td>
</tr>
<tr>
<td>Outside resources</td>
<td>Few, if any, consultants</td>
<td>Consultant led initiative</td>
</tr>
<tr>
<td>Physical separation</td>
<td>No, part time team members</td>
<td>Yes, “off-campus site”</td>
</tr>
<tr>
<td>Crisis</td>
<td>None</td>
<td>Poor performance</td>
</tr>
<tr>
<td>Milestones</td>
<td>Flexible</td>
<td>Firm</td>
</tr>
<tr>
<td>Reward system</td>
<td>Unchanged</td>
<td>New</td>
</tr>
<tr>
<td>IT/process change</td>
<td>Process first</td>
<td>Simultaneous process and IT change</td>
</tr>
</tbody>
</table>

The critical element in choosing between a revolutionary and evolutionary approach is time

- If the firm is in a reactive mode responding to a crisis ⇒ a revolutionary approach may be the only option
- If in a proactive mode ⇒ an evolutionary tactic might work
The Evolutionary Change Model (I)

- Basic principle
  - People directly affected by or involved in a change process must take active part in the design and implementation of that change
  - Real change is achieved through incremental improvement over time
- Change should come from within the current organization
  - Should be carried out by current employees and leadership
  - Should be adapted to existing resources and capabilities ⇒ flexible milestones
  - Should be based on open and broad communication
- New processes and procedures are implemented before introducing new IT systems
The Evolutionary Change Model (II)

Advantages of an evolutionary change tactic compared to a revolutionary approach
- Less disruptive and risky
- Increases the organization's ability to change

Disadvantages
- Takes a long time to see results
- Does not offer the same potential for order of magnitude improvements
- Vision must be kept alive and adjusted over time as external market conditions change
The Revolutionary Change Model (I)

- Based on the punctuated equilibrium paradigm
  - Radical change occurring at certain instances
  - Long periods of incremental change in between

- Revolutionary change
  - Happens quickly
  - Alters the very foundation of the business and its culture
  - Brings disorder, uncertainty, and identity crises
  - Needs to be top driven
  - Requires external resources and new perspectives
  - Involves tough decisions, cost cutting, and conflict resolution

- The change team is small and isolated from the rest of the organization
  - Avoid undue influence from current operations
  - Communication with people in the process is on a “need to know” basis
Advantages with a revolutionary implementation approach

- Drastic results can be achieved quickly
- If successful, the ideal “blueprinted” design is put in place

Disadvantages with a revolutionary change tactic

- Very strenuous for the organization
- High probability for failure
- Diverts top management attention from the external marketplace
- Goes against core values of many organizations
  ✓ Empowerment
  ✓ Bottom-up involvement
  ✓ Innovation
- Secrecy creates uncertainty about the future roles of individual employees ⇒ resistance to change