Building Collaborative Systems

Chapters 6 through 9 describe the steps involved with the introduction of collaborative systems and highlight what needs to be done to get the development right. In these chapters we look at how to build applications to help groups work together. Guidance on building groupware and workflow solutions is given by looking at the standard stages of a software development project from its start, when the right tool must be selected through analysis of the processes through to design and implementation of the system.

Chapter 6 looks at how to select the components of the system—what are the key requirements, what is available and which criteria you should use. Different products are compared in this chapter.

Chapter 7 considers in more depth how to analyze the business requirements of workflow systems. In particular it looks at methods of mapping the business processes so that they can then be used for designing workflow.

Chapter 8 looks at design factors important in building a system which end users will be happy with. These factors include performance, usability and security. Topics covered include the design of the hardware architecture, security and the human–computer interface.

Chapter 9 describes practical implementation issues such as testing and deployment options. How the users of the new system should be involved at each stage is an underlying theme to all these chapters.

Chapter 10 attempts to gaze into the future of how groupware, workflow and intranet systems may evolve from the current snapshot.

2

Reengineering and Process Improvement Using Collaborative Software

Why Reengineer?

Companies reengineer because of the promise of massive improvements in the efficiency of their business operations leading to improved business performance and better customer service. Promises offered include customer service index increased by 100%; time for issuing a loan reduced by 200%; staff needed for a process reduced by 300%. This chapter shows how groupware and workflow software can help in reengineering the enterprise.

So, how can collaborative software help reengineer the enterprise? The processes ripe for assistance are typically manual business processes which involve information processing when providing an internal or external customer with a service. Collaborative software is important to reengineering since the traditional hierarchies created in larger companies are usually broken down. The new, flatter structure with more process oriented teams needs software to support it. Of course collaborative software is not only used when companies are undertaking large scale reengineering, but can also be used with smaller scale improvements in the operation of a company.

Caution Required—The Reengineering Gamble

The logic behind the radical redesign or reengineering of processes is that while *small* adjustments and automation of existing processes may result in some performance improvements, these will be *small* in magnitude—measured in tens of percent. With BPR much larger gains, possibly of several hundred percent in performance, can be achieved. But reengineering also offers the largest risk.

Despite the promise of tremendous improvements, many reengineering projects fail; some surveys show the failure rate at 70 to 80%, so a cautious

approach is necessary. The emphasis in the remainder of the book is on how to avoid the reversal of the big promises so improvements are delivered using groupware and workflow software and intranets. Trying for more limited improvements in processes through automation is also another way to limit the risk.

BPR was popularized in the early 1990s, and the term that is used to describe such business improvements will certainly change. Today BPR is being replaced by terms such as continuous improvement or process improvement to indicate that the lower risk option of gradually refining some processes is often best. However, improvement or redesign of business processes will certainly continue into the future.

In This Chapter

The use of collaborative systems to assist in both gradual process improvement and radical reengineering are both covered in this chapter. We start by considering how companies use IT, and in particular collaborative systems, to support their business strategy. We then look at how collaborative systems can support BPR and process improvement. Methodologies for the typical stages of a BPR program are related to the subsequent chapters on analysis, design and implementation. Overall, this chapter provides a framework for the remaining chapters which describe how to introduce collaborative systems into a workgroup or company. The important role of metrics in measuring the performance of processes is also examined in this chapter. It is shown how workflow systems are important in helping to collect metrics. Many of the issues discussed in this chapter are also covered by articles on the reference web site, "a business researcher's interests." This is recommended.

Web reference: http://www.brint.com

Implementing the IS Strategy

We will start by assuming that a company has an established business strategy and is looking to IT to help achieve its goals. An early decision when implementing the business strategy is whether to adopt and improve existing processes in a process improvement program or to completely reengineer them. With any new IS or groupware implementation there are three basic alternatives:

- **Automate existing ways of working**—Automate the existing working methods using computers to assist in performing tasks, but retaining the existing task structure. This is often referred to as doing bad things faster.

- **Improve key processes**—Base the office automation on the existing processes, but improve some key areas such as the most time consuming tasks or those involving customer service. This is process improvement.
- **Reengineer the business**—Make major modifications to the processes and the roles of the agents performing them. This often involves developing systems which work across functions rather than in a single traditional workgroup, which is the norm with automation.

Which of these is the right decision depends largely on the extent to which managers are prepared to take a risk. Although reengineering can potentially offer the largest gain, it also poses the largest risk. Often the intermediate option is best since this can give significant improvements in productivity, but without the higher risk of reengineering. Of course most companies who perform reengineering will previously have had the benefit of implementing an IT system to partially automate the business process. Through this they will have learnt from mistakes and identify processes which will particularly benefit from reengineering.

How Should IS Strategy Support Process Improvement?

Useful guidelines for developing an IS strategy to support process improvement have been developed by many of the large management consultants. Arthur Andersen Consulting recommends the following best practices for improving the management of information resources within an organization. Here, in the box "Guidelines for Supporting Process Improvement," I have applied the guidelines to show how collaborative systems can assist a company in restructuring its processes.

Web reference: http://www.arthurandersen.com (Describes global best practices initiative and /bp.)

How Can Groupware and Workflow Support Reengineering?

Collaborative Systems Can Support All Stages of Process Improvement

Each of the primary functions of groupware and intranets—communication, collaboration and coordination are important to BPR. With the introduction of matrix management and cross-functional teams in the reengineered company a superior means of communication and information sharing is required, and, of course, collaborative systems provide these. Davenport (1993) has also noted that group tools and e-mail are valuable in supporting the analysis and planning stages of BPR through helping communication across organizational and geographical barriers. For the new business processes to operate efficiently groupware and workflow will help the people involved with them communicate effectively.

Guidelines for Supporting Process Improvement

1. **"Develop and maintain an IT strategy that is integrated and aligned with the company's business goals."**
   Closely aligned business and IT strategies are necessary so that IT solutions are implemented to support business goals. Information resources should be made available through collaborative systems to support decision making at all levels within the company: strategic, tactical and operational.
2. **"Create and foster a customer focus for the IT organization and personnel."**
   Action Technologies considers customer focus in processes so critical that their workflow process model is defined through specifying a customer and a supplier for each sub-process (Chapter 7). This customer-supplier relationship puts the spotlight on customer service and can boost the quality of solutions delivered. Customer focus can apply to both internal or external customers.
3. **"Design an IT organization that maximizes support for the company's various business groups."**
   This guideline indicates that although processes and their supporting teams may seem to operate independently, it would be a mistake to think there are no links between these processes. Groupware is important in allowing information to be shared between different teams as well as within teams.
4. **"Use a centralized IT function to set enterprise-wide architecture standards."**
   This is important to ensure the adoption of common applications and standards throughout the company to reduce cost, but also to minimize technical problems of incompatibility between applications and promote information exchange throughout the organization.
5. **"Develop a clearly communicated process for integrating new technology into the business."**
   The final point emphasizes the importance of explaining through training why new collaborative technologies are being introduced and developing a plan so that there are no surprises for employees as new technologies are brought in to support processes. A culture can then be established where continuous change is familiar. It is then no surprise as new technologies are introduced to support changing business needs.

Management and monitoring of processes is also important to continuously refine them. Here, too, collaborative systems can help through automatic collection of metrics. The administrative modules of many workflow systems provide a powerful view of how well a process is functioning as is described later in this chapter.

Collaborative Systems Are a Catalyst for Change

In *Reengineering the Corporation*, Hammer and Champy (1993) identify a number of new technologies which are important to BPR, not only in providing a means of supporting processes, but also because they act as catalysts for change within companies. Collaborative systems don't figure as such in this list, but several supporting technologies do, such as tracking technology, decision support tools, telecommunications networks, teleconferencing and shared databases.

Hammer and Champy label these as "disruptive technologies" which can force companies to reconsider their processes and find new ways of operating. This is certainly also true for workflow and groupware systems and it is rare that a company that has the vision to undertake reengineering does not adopt some of the functions available in collaborative systems.

Hammer and Champy give examples of early experiences of reengineering by large companies such as Kodak which used group supported CAD/CAM software to perform concurrent engineering on their products and so slash new product development times. In another business function Ford used the introduction of a software system to reduce the number of staff in their accounts payable unit from 500 to 125.

Redesigning the Process Is More Important Than the Software!

It would be wrong to believe that improved process performance can only be achieved through the introduction of technology. While this will help, it is the fundamental redesign of the processes—the introduction of new ways of working—which is responsible for the greatest improvements. For example, when IBM Credit reengineered their process for financing hardware and software, they effectively moved from a six stage process handled by different staff to a one stage process by retraining and replacing specialists with generalists who performed all the original tasks. The six original stages, each involving different people were:

1. Log credit request
2. Check credit-worthiness via computer system
3. Specify special terms by modifying standard terms in another computer system
4. Price finance terms and set interest rate using spreadsheet
5. Collate information to verify quote
6. Issue quote letter

The new process, involving a single person was:

1. Credit issue

In reducing the number of stages the process was improved from an average of six days to four hours, which was close to the minimum theoretical time of 90 minutes which was recorded when a walk-through of the original process was conducted. Note that it would be possible to use software to help these separate staff collaborate and this would produce gains. However, much more significant gains were achieved by rethinking the process completely. So when introducing groupware and workflow systems, simple automation of existing processes may not give you the best benefit, although it will carry a lower risk than reengineering.

How to Reengineer

Many commentators on BPR, such as Hammer, Champy and Davenport, exhort companies to reengineer, but without giving detailed guidelines on how to achieve this. There is a growing range of literature which describes how to undertake BPR. Figure 2.1 shows Obolensky's recommended stages for reengineering. The first stages are involved with creating a vision for the company at a senior level and then planning the implementation. Then follows the stage of actually doing reengineering which covers activities described in this book such as process analysis, design and implementation. After the reengineered system is up and running, collecting metrics occurs so

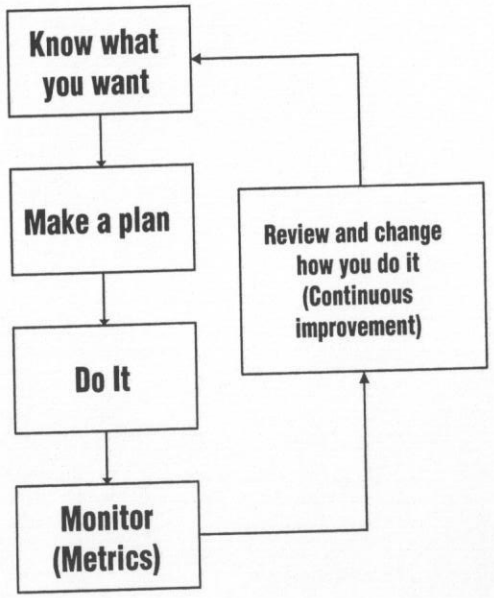

Figure 2.1 *Stages in Reengineering. Adapted from Obolensky, N.* Practical Business Reengineering. *London: Kogan Page*

that the processes of the company can be continuously improved to keep up with or be one step ahead of the competition.

Reengineering Methodologies

There is no single well-known methodology for performing a BPR program in the same way that there are different methodologies for developing information systems. Rather than detailed, prescriptive methodologies, each systems integrator or management consultancy tends to have their own stated best practice. One of the better known is the Breakpoint BPR methodology developed by Coopers and Lybrand. It has three phases: Discover, Redesign and Realize:

- Phase 1 is the initiation, in which the project vision and communications strategy is developed, processes for redesign are identified and teams are built.
- Phase 2 is the redesign, modules are Mobilize, Analyze, Innovate, Engineer and Commit.
- Phase 3 is Mobilize, Communicate, Act, Measure and Sustain.

Mobilization of the workforce through promotion and education is important throughout to ensure that the vision and commitment is shared by all company staff. The Breakpoint BPR methodology shares high level similarities with other methodologies in that the major activities usually included are:

1. Development of strategic vision and communication to staff.
2. Development of a BPR or organizational change management plan.
3. Establishing new or revised processes and performance measures.
4. Implementation of improved process systems.

The order in which activities are conducted is open to variation. Some consultancies advise an initial analysis of existing processes or benchmarking before design and creation of new processes. Others say that dwelling on the current situation too much stifles initiative and the analysis should be more forward looking. The box "Ten Steps to Reengineering" shows the typical activities that occur in a reengineering project. Many of these are appropriate for a major implementation of a collaborative system. Of course some activities may not always occur and the sequence varies from case to case.

The Role of Process Metrics in Reengineering

When creating company vision and strategy the objectives of the company are often couched in grand phrases of "being the best" or "delivering world-class

Ten Steps to Reengineering

1. **Initiate BPR program.** Strategy identifies need for change so a project is initiated. The following need to occur:
   - Management buy-in necessary to promote vision, explain need for change to staff and provide continued support
   - Feasibility study and risk analysis to ensure benefits outweigh costs
   - Ensure IS function is integral to change team
   - Establish reengineering team (i.e., director level sponsor and stakeholders for each key process)
   - Appoint project manager and develop schedule
2. **Define scope.** Decide on extent or domain of reengineering ambition. Ask questions such as:
   - Are we going to reengineer or improve (redesign) our existing processes?
   - Where do we establish the boundary to reengineering?
   - If we redesign key processes, which ones and how do we phase them?
3. **Selection and procurement.** Select appropriate technologies and system integrators to assist reengineering (Chapter 6).
4. **Define baseline.** Understand existing processes through documenting and measuring to produce a baseline or "as is" model. Note that some reengineering gurus suggest this process capture stage is not performed by reengineering teams since it will block innovation or "new process thinking."
5. **Benchmark.** Benchmark to comparable "best of breed" organizations. This provides information on how others have updated their processes and also the technologies they are using to support them. Comparisons of your baseline processes may highlight a big gap with best of breed companies.
6. **Establish pilot process or domain.**
   - Identify processes involved (one or many).
   - Identify functional areas involved.
   - Identify users impacted.

   Often the processes with great potential for improvement are also high risk since they are complex, mission critical, probably involve customer contact and service and may be high cost and high visibility. You will need to balance risk against gain.
7. **Process analysis and redesign.** Start detailed process analysis and redesign (Chapter 7).
   - Identify problem processes, perhaps using Pareto analysis.
   - Develop ideas for new processes through brainstorming and more structured group techniques such as nominal group techniques where the alternatives are assessed in a structured way using GDSS such as GroupSystems (Chapter 3).
   - Develop scenarios and use-cases (i.e. activities and players making up processes).
   - Produce a wish list of capabilities for new process and corresponding Business Rules.
   - Rapid organizational prototypes of modified processes should be developed.
   - Possibly simulate new process with software.
8. **Engineer.** Develop new or revised business process through analysis, design and development of supporting information system including integration with legacy systems (Chapters 7 and 8).
9. **Implement.** Integrate new or revised processes into the organization. A change management program should manage organizational change (Chapter 9), reengineering is notorious amongst staff as a threat; this needs to be countered through involvement and education of the benefits of change.
10. **Continuous improvement.** Monitor process through metrics, leading to continuous improvement.

customer service." Moving towards these aims is only possible if you use measures to compare against your own baseline position, or against competitors before reengineering. A wide variety of metrics have been developed and whole books have been written on how to devise and collect them. The aim here is to indicate how different types of metrics may be used in a project which involves the introduction of a collaborative system. Metrics are reviewed from three main perspectives:

- High level measures such as critical success factors used to ensure the aims of principal business processes are consistent with corporate objectives
- Benchmarking to understand how your company compares with another in the same sector
- Detailed metrics describing the efficiency of a process are built into collaborative systems to reduce the cost of collection of metrics and provide managers with easy access to metrics

When to Use Metrics

Metrics can be used at all stages in a reengineering program as shown in Figure 2.2. Initially they can be used to help define the existing processes. They can be used in combination with simulation to choose the best of proposed alternative processes and when the system has been developed, to monitor the business processes so that continuous improvement can occur.

A Role for Simulation?

At an early stage in the project, simulation modeling of processes is particularly useful for workflow systems. This can enable:

- Choice between alternative processes
- Assessment of the effectiveness and optimization of an improved process
- Reduced disruption during implementation
- Reduced cost compared to building and evaluating alternatives

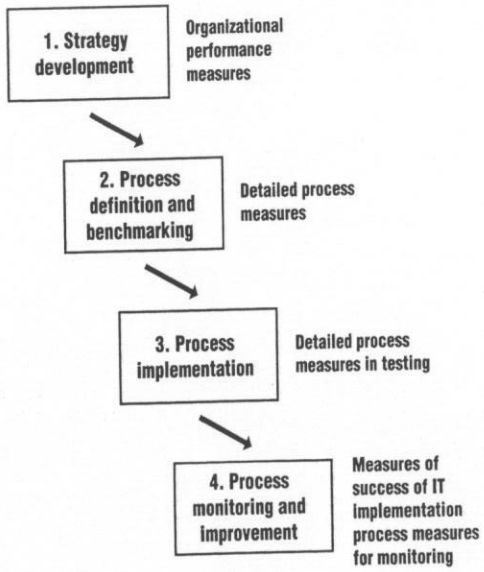

Figure 2.2 *The role of metrics at different stages of BPR*

Simulation for workflow systems using products such as Metasoftware's Workflow Analyzer are covered further in Chapter 7.

High Level Measures—Critical Success Factors

Critical success factors (CSFs) are frequently used by companies to ensure that their key processes are delivering the objectives of the strategic business plan. A CSF will usually have an associated key indicator which allows it to be measured. Typical CSFs based on key performance indicators could include:

- Improve customer satisfaction index by 50%
- Reduce errors by 80%
- Reduce process management overheads by 100%
- Increase business unit profits by 10%

Table 2.1 is an example of how a real estate agency identified qualitative CSFs which were related to key business processes and how functions of a workflow system were specified to help achieve the CSFs. In this way CSFs can provide a straightforward method for ensuring that your collaborative system is linked to your strategic objectives.

Table 2.1 *Critical Success Factors for a real estate business and how revised business processes are achieved through a workflow system (Chaffey, 1996)*

CSF	*Achieve through*	*Workflow system to assist through*	*Business process*
Achieve inspections (viewings)	Attracting vendor for valuation of property	Illustrating efficiency of business (workflow, status indicators). Larger number of applicants will see property	Obtain listing
Market property to ensure offers received and accepted	Attracting applicant to branch, viewing properties	Workflow component to prompt negotiators to perform marketing activities and update vendors according to status	Market property
Achieve completion revenue	Controlling progress to completion	Workflow component to prompt negotiators to check with all parties involved in sale	Facilitate sale
Improve performance of sales staff	Personal characteristics	System to be used as a sales tool and promote collaboration between staff	All above processes
Managers to ensure that CSFs are achieved	Business and management skills	Monitoring of staff workflow Monitoring of branch performance by reports	Manage process

Benchmarking

Benchmarking is used to compare a company's process performance with others in its field of operation, typically compared with "best of breed." Benchmarking can work at two levels. First, it can be used to compare processes which are common to similar companies. Thus a tourism services company can compare how it selects the best holiday deal for a customer. Benchmarking uses metrics such as customer service levels, productivity and cycle times to compare processes. Lessons can then be learned by developing best practices through considering how processes are performed differently in the higher achieving company.

Second, benchmarking can be used to compare the performance of the information systems and also how they are developed and supported. Companies can best compare collaborative systems in terms of their speed of processing customer-related tasks such as dealing with a complaint.

Detailed Process Metrics

Metrics are important within BPR since only through these can we establish whether the hoped for improvements have been achieved and monitor how future improvements occur through time. They are significant within the context of this book since metrics can be usefully built into collaborative software to reduce the cost of their collection. This has the added benefit that they will then also have a high visibility with end users and managers using them to support their daily activities and measure their own performance. More detailed measures reflect the detailed performance of business processes and the "actors"—the people doing the work, the software and hardware. With workflow software these are often transaction based, for example:

- the number of bank customers handled per hour by an operator in a call center
- the number of seconds it takes to retrieve their personal details
- total time taken to complete a case

Such detail is obviously of importance in improving customer service. When using workflow systems another common metric is the length of the workflow queue of outstanding tasks. In my experience staff react positively to this and like to try clear the queue as far as possible by the end of the day.

There are no well established classifications of the types of business metrics used in reengineering—various terms are used. Table 2.2 summarizes some of the terms for different types of metrics that are found. Measures can occur at the company or process level and may be internal to the process or external if they describe its outputs—there are often overlaps between the types of metrics shown in the table.

Table 2.2 *Different types of metrics*

Metric	*Notes*	*Examples*
Organizational performance measures	These are "external" metrics which measure the outputs of businesses processes often using financial measures	Turnover, profitability, market share and customer satisfaction
Process performance measures	May include organizational measures at process level. These will include "internal" or diagnostic measures to monitor the process itself	Lead-time, profitability of process

Table 2.2 *Different types of metrics (continued)*

Metric	*Notes*	*Examples*
Critical Success Factors	Refer to organizational measures or processes	Customer service index and Employee satisfaction
Defect based metrics	Number of failures in a set period of time. Transactions between customers and suppliers can be measured as successful (on time) or unsuccessful (late). Through reengineering and continuous improvement the proportion of defects can be reduced.	Customer complaints or number of cases that are not processed within the target time
Project based metrics	Measure success of project through indicating whether the project is delivered on time or within budget	% of budget % of time
Quality metrics	These are based on Quality programs	Quality gap—SERVPERF SPC control charts Quality Function Deployment (relate customer quality to engineering factors)
Integrated metrics	See section below	Balanced scorecards

Balanced Scorecards

Many companies have metric collection programs separately covering the key dimensions of cost, time, quality and customer satisfaction. Integrated metrics such as the balanced scorecard have only become widely used recently.

The balanced scorecard, popularized in a *Harvard Business Review* article by Kaplan and Norton (1992) is intended to translate a reengineering vision and strategy into specific objectives. They use financial data, operational measures such as customer satisfaction, performance of internal processes and also the organization's innovation and improvement activities (indicators of future financial performance). The scorecard is structured in four main areas:

- **Customer concerns.** These include time (lead time, time to quote, etc.), quality, performance, service and cost.

- **Internal measures** (time, volume). Internal measures should stem from the business processes that have the greatest impact on customer satisfaction: cycle time, quality, employee skills and productivity. Companies should also identify critical core competencies and try to guarantee market leadership.
- **Financial measures**
- **Learning and growth: Innovation.** Innovation can be measured by change in value through time (employee value, shareholder value, percentage and value of sales from products less than x years old).

Workflow systems are particularly good at capturing metrics in the first two areas.

Collecting SMART Metrics

Many companies do not include metrics collection other than basic financial measures as part of their business operation before reengineering. With reengineering and total quality management programs a culture of metrics is usually fostered. However, with newly adopted metrics programs many problems can develop. Jeff Hiatt of the ProSci consultancy and Nick Obolensky suggest the widely used mnemonic SMART to advise clients on developing metrics, i.e. metrics must be:

⇨ Specific
⇨ Measurable
⇨ Actionable
⇨ Relevant
⇨ Timely

They advise starting with external measures initially, such as customer satisfaction, and then moving to detailed internal diagnostic measures.

Using SMART metrics avoids the following types of problems:

1. Developing metrics for which you cannot collect accurate or complete data.
2. Developing metrics that measure the right thing, but cause people to act in a way contrary to the best interest of the business to simply "make their numbers."
3. Developing so many metrics that you create excessive overhead and red tape.
4. Developing metrics that are complex and difficult to explain to others.

Web reference: http://www.prosci.com. Contains detailed resources on methods of BPR.

Metrics and Collaborative Systems

Metrics should be considered carefully when analyzing and designing collaborative systems since they provide an automated way of collection. If metrics are collected manually this can be disruptive and time-consuming. Metrics that are collected in this way are sometimes known as "virtual metrics." The following types of metrics can all be generated from a workflow system or can be used earlier to compare candidate processes.

- Time—cycle time
- Volume—throughput, materials usage
- Cost—derived from volume measures
- Complexity (based on process definitions)
- Number of sub-processes
- Number of alternative routes and number of hand-offs
- Length of shortest route
- Quality

The types of information metrics monitored by collaborative systems is well illustrated by the output available from the metrics module of the workflow product Staffware. This module groups metrics in the following types of areas:

1. What is our staff working on?

This shows the number of tasks each staff member is working on (number of outstanding or aged items on work queue).

2. What has been achieved?

This shows for each worker or type of worker how far the cases on the workflow have progressed—the proportion that have been started, been released to another worker or withdrawn.

3. Are we meeting our service levels?

Length of time to achieve certain stages in the overall process. This is illustrated in Figure 2.3.

4. What happened to this case?

This shows the time taken for each of the sub-processes.

As well as internal metrics looking at how well the workflow assisted processes are performing, external metrics are also required. A customer

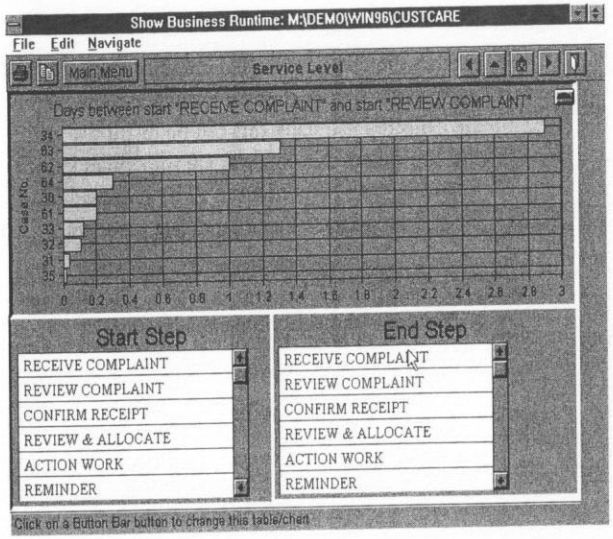

Figure 2.3
Customer service level metrics for complaints handling in a workflow application using Staffware

satisfaction index indicating their perceived level of service can be recorded regularly through conducting regular interviews or questionnaires with customers. Open questions asking about the process may highlight where the customer is experiencing delays or is not getting the information they need. The employees should not be neglected either. The effect of the system on their motivation and morale should be established to help make future improvements. These types of metrics cannot be directly recorded by collaborative systems, but could be input to a workflow system to be used alongside the other metrics.

Some Problems of Reengineering— Why Do 70% of Implementations Fail?

Despite the potential benefits of BPR, there are many problems that can and often do occur which may cause the reengineering effort to fail. Reasons for failure include:

- Lack of support from the top and an inability of senior management to maintain commitment
- Selecting the wrong scope for reengineering such as reengineering everything without piloting less critical processes first or reengineering non-critical, adequate processes

- Failure of implementation due to poor project management, insufficient resources or change management skills
- Failure of implementation due to technical difficulties such as failure to integrate systems, lack of methodology, inadequate performance or insufficient testing

While some of the best known reasons for failure are lack of management commitment or poor project management, technical problems are also important. The remaining chapters look at the technical decisions which must be made at different stages of the project and attempt to ensure that these type of mistakes are guarded against. The next section introduces these chapters.

Since many managers are wary of the returns IT can bring, there are also examples of IT being underused in BPR programs or the IT department being excluded from the redesign team because they are not directly involved in any of the processes. Given this and the high failure rate of BPR programs these guidelines for implementation from Davenport (1993) are useful:

- Recognize that IT is only part of the solution: it allows managers to collect, store, analyze, communicate and distribute information better.
- Cut and paste the IT tools needed, i.e. don't use tools from a single vendor, but use "best of breed."
- Bring in internal or external IT experts: their knowledge, skills, acumen and experience are invaluable.
- After implementation, continually monitor IT performance and keep up with new IT developments.

Stages in Developing Collaborative Systems

The major activities involved in developing a typical collaborative system are similar to any software development project. These well known stages from inception through analysis and design to build are shown in Figure 2.4.

Of course, in the real world the picture is a lot more complicated than this since when requirements change, which is sure to happen as feedback on prototypes occurs, we will need to start again at the top of the waterfall and repeat the analysis, design and build (code, test and review). This iteration occurs as initial prototypes are built for different functions or modules of the system, then reviewed, and redesigned and reimplemented in line with the new requirements of the end users.

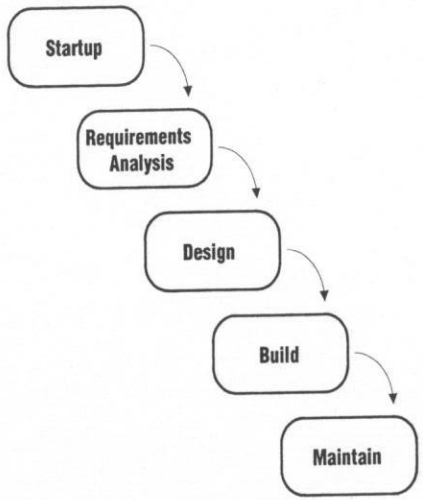

Figure 2.4 *The waterfall model of systems development*

Figure 2.5 gives an idea of what really happens on a project. Here, following initial analysis, a framework for the overall application will be built into which the different modules of the system can be plugged as they are developed. The application framework and each of the modules will go through several iterations of prototyping in the analysis-design-code-review cycle.

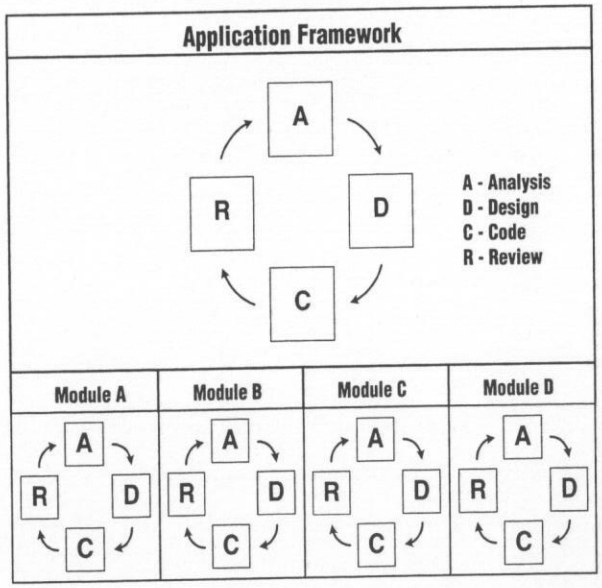

Figure 2.5 *What really happens—an iterative software development model*

Chapter 9 gives further details on how prototyping is used in rapid applications development (RAD). Following testing and review, the cycle will be started again until the component is complete. Early versions of each module may be reviewed separately, but as they evolve they will need to be tested for integration with other parts of the system. Given that each of the modules is probably being developed independently by a different programmer or team, this makes synchronization of intermediate builds difficult, so clear objectives must be stated for each module, namely the target date for the integration build and which features must be completed for this build. For a workflow system typical modules or activities that might be developed separately but would need to be available together for a user review are:

- process definition module
- work management module—activity completion screen
- administration module
- workflow engine

A similar view of software development is given by the spiral model proposed by Barry Boehm in 1988. This is a risk based model where each cycle in the spiral addresses the stages of analysis, design, code and review for the different modules of the product. Each cycle in the spiral involves the identification of objectives, constraints and risk factors and methods of how to minimize them. At each stage there is a review to ensure that all parties are committed to the next phase.

Despite the complex nature of development, the activities of each stage of the waterfall do all still occur and provide a sensible framework for looking and the methods and pitfalls for developing collaborative software. Chapter 6 looks at important decisions in the early stages of the project such as do we build a new system or do we use a pre-existing tool, and if so which one do we choose? Chapter 7 concentrates on how to perform process analysis for workflow systems. Chapter 8 considers design issues such as security and the user interface. Finally, Chapter 9 looks at development and deployment.

The aim is not to provide comprehensive coverage of what needs to happen at each stage in the development project, that is the role of a book on project management. Rather, it is to highlight which issues are important to the development of groupware and workflow systems.