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Business Process Reengineering

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BUSINESS PROCESS REENGINEERING

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At the Lotus Feet

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PREFACE

Business process reengineering (BPR) is a tool to help organizations to improve customer services, cut operational costs and become leaders in their domain. The key elements of BPR have been the continuous development and deployment of sophisticated information systems and networks. Business process reengineering (BPR) could act as an important strategic tool for sustained competitive advantage for Indian companies in the present context.

This book embodies the objectives, scope, strategic perspective, possible models, implementation and success factors as well as future course of BPR. This book also focuses on IT and EPR in BPR and discusses case studies on BPR. The students will be able to appreciate the need for BPR in Indian companies and understand how to go about implementing it in a systematic manner. This is illustrated through a comprehensive case study. They will also get actual insights from the Indian context about BPR implementation.

The book is divided into three parts. Part 1, Essentials of BPR, focuses on objectives, strategic perspective, possible models and future course of BPR. Part II, Business Process Innovation, highlights benchmarking, change management and process mapping in the context of BPR. This will help the students to have a structured approach towards the subject. Part III, Applications of BPR, discusses a case study on BPR on measures of competitive advantage and presents three cases of successful BPR implementation.

I would like to express my appreciation to a number of students who have inspired me to write this book by their sheer enthusiasm and thought-provoking and probing questions. Particular mention should be made of Dr Pallab Saha, who worked for his doctoral research under my guidance on this topic.

I wish to sincerely thank my wife, Jayashree, and my children, S. Srinidhi and S. Shrihsa, for putting up with me while I was busy preparing the manuscript.

Constructive suggestions for improving the book are welcome.

R. Srinivasan

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PART 1

Essentials of BPR

This part comprises the following chapters:

1. Introduction to BPR
2. Enablers to BPR
3. BPR and Industrial Engineering
4. Strategic Perspectives of BPR
5. Major Business Processes of Reengineering
6. IT, Software Reengineering and ERP in BPR
7. Possible Models of Reengineering
8. BPR Implementation and Success Factors
9. Future Course of BPR in Indian Organizations

1

INTRODUCTION TO BPR

Learning Objectives

This chapter will help the reader in

- Understanding the concept of BPR
- Getting an overview of the current BPR Scenario
- Understanding the concept of BPR vision
- Comparing reengineering with other change management practices
- Identifying the major components of BPR
- Understanding the concepts of the process management model

1.1 CURRENT SITUATION

The process of liberalization of the Indian economy started more than a decade ago. The opening up of the economy has resulted in a large number of multinational companies entering the Indian market. It has also put question marks on Indian companies both in the public and private sectors, as they have not yet adapted to this scenario. The Indian economy has gone through a sea change during this period.

It was noticed in the mid–1980s that some American companies had dramatically improved their performance in one or more areas of business by radically changing their way of working. The point of interest was that the companies did not change their businesses; rather they significantly altered the processes being followed or even replaced the old processes entirely.

This throws up cues for Indian companies to survive and prosper in the increasingly competitive climate. The Indian companies should be willing to look across and beyond financial departments to processes. This is not an easy task, since they have been committed for years to traditional methods of working.

A *process* stands for a set of activities that, taken together, produce a result of value to a customer, for example, producing a new product. A change in process is accompanied by a radical change in the shape and character of those parts of the organisation that are involved in performing it.

The current Indian scenario is characterized by three forces, represented by 3Cs. They are:

- Customers
- Change
- Competition

These may be hardly new but the characteristics of the 3Cs are drastically different from what they were before liberalization. The present day Indian Customer is demanding. He wants specific attributes to be included in products. This is making the traditional manufacturing process industries to think very hard on how to satisfy the customer. If the Indian manufacturing companies are not able to do it, the new foreign players who have entered will grab the market to the disadvantage of the Indian players.

The second "C" which the Indian companies are facing due to liberalization is intense Competition. This has resulted in Indian companies not only requiring to produce quality products but also keep the price competitive.

The third "C", Change appears to be the factor which is more or less constantly happening in the present Indian scenario. It has become imperative to adapt to

this change whether it is the changing markets or the changing technologies. On the one hand liberalization has created opportunities for Indian companies but on the other hand it has also spelled doom for companies which are not able to adapt to this changed situation.

The Indian companies should ask the questions "Why do we do? What do we do at all"? instead of asking "How can we do? What we do faster"? or "how can we do what we do better"? or "how can we do what we do at a lower cost"? Answer to these above questions is likely to a lead us to a set of procedures for effecting radical change. This is referred to as "Business Process Reengineering(BPR)". Reengineering cannot be carried out in small or cautious steps. It has to be 'an all or nothing' proposition that produces dramatically impressive results. It is imperative for the Indian companies to muster courage to do it. It is the only hope for breaking away from ineffective antiquated ways of conducting business, which will inevitably destroy them.

1.2 BPR—A TOOL FOR CHANGE

In the present day context BPR can become a crucial strategy tool for winning. The progress in IT can be used as a key driver to reengineering success. This is especially so in the present context when distributed computing is likely to be used as a strategic tool.

Reengineering success of the firm can be possible by driving technology, business and organisation components to be congruent with each other. Leveraging information technology to transform today's heterogeneous proprietary systems into an enterprise wide standards based open network is a critical initiative—that could be referred to as an open information technology initiative.

1.3 DEFINITION OF REENGINEERING

It is essential that before we discuss what reengineering really is to know what it is not. There are many misconceptions about reengineering. Organisations go through major re-haul and call it reengineering. Others downsize their staff strength by 50% and call it reengineering. Sometimes, efficiency programmes run by companies are referred to as reengineering.

It has to be understood that reengineering does not mean 're-organizing'. Re-organization looks at the work required to be done and not the organisation structure. Organisation structure is designed to support the process necessary for producing the products of the firm.

Reengineering also does not mean downsizing. Downsizing refers to employee reduction to achieve cost reductions in the short term. Reengineering focuses on

re-thinking works from ground upwards, eliminates work that is not necessary and considers more effective ways of doing work.

Further, reengineering does not imply making an organisation more efficient. An organization may have very efficient operations but if it fails to effectively serve its customers, then its mission is not accomplished. Reengineering is about creating value for customers. From a customer's perspective, *value* can be defined as lower cost, higher quality or increased response time.

According to Hammer and Champy (1993), "reengineering is 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". This definition has four key words:

- Fundamental
- Radical
- Dramatic
- Processes

The first word, *fundamental*, suggests that companies undertaking reengineering must guard against the assumptions that most processes have already been enabled in them. Reengineering determines what a company must do and how to do it. It does not take anything for granted. It does not consider 'what is' but concentrates on 'what should be'.

Radical redesign requires getting to the root of things and not making superficial changes. Reengineering is concerned with business reinvention and not business improvement, enhancement or modification. It is undertaken by companies which are in deep trouble, or whose management has the foresight or those in peak performance conditions. An example of a company in deep trouble which used business reengineering to come out is Ford Motor Company in the early 1980s.

New competitors, changing customer requirements or characteristics, altered regulators or economic environment may threaten to sweep away the foundation of a company's success. Those companies which have the vision to begin reengineering do not face adversities in the future. Public sector companies like BHEL or BEML are performing satisfactorily but the changed environment does not assure success for a long time. Such companies would be better off to use reengineering. Peak performing companies can race their competitive bar to even higher levels by using reengineering and make life tougher for competitors.

The term *dramatic* refers to improvements in business process, which can impact the efficiency of the process in a positive manner. Many a time, the increase in efficiency can be more than 50%.

Processes are the compartments where most businesses have great difficulty. It is not that the companies are not process oriented, they are focused on job, people, structure, and not on production. This is discussed further in the next section.

1.4 DEFINITION OF BUSINESS PROCESS

In this subsection, we define business process more clearly. According to Davenport and Short (1990), *business process is a set of logically related tasks performed to achieve a defined business outcome.* A *process* according to Davenport (1994), is *a structured measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on how work is done within an organisation.* According to them, processes have two important characteristics:

(i) They have customers, who can be internal or external.
(ii) They have cross-organisational boundaries, i.e., they occur across or between organizational subunits.

Value chain suggested by Porter (1985), can be used as a technology for identifying business processes in an organization. Processes are identified in terms of beginning and end points, interfaces and organizational units involved, particularly the customer unit. High impact processes should have process owners. Examples of processes can be developing a new product, ordering goods from a supplier, drawing up a marketing plan, guest check in a hotel, etc.

According to Davenport and Short, process can be defined on three dimensions:

(i) **Entities**: Processes take place between organizational entities. They could be *interorganizational*, *interfunctional* or *interpersonal.*
(ii) **Objects**: Processes result in manipulation of objects. These objects could be *physical* or *informational.*
(iii) **Activities**: Processes could involve two types of activities: *managerial* (for example, develop a budget) or *operational* (for example, fill a customer order).

1.5 DEFINITION OF BUSINESS PROCESS REENGINEERING

According to Hammer and Champy (1993), BPR can be defined as 'Reengineering the Corporation, a Manifesto for Business Revolution'. Sometimes, BPR is used synonymously with business reengineering, business process redesign, process innovation and business process innovation. However, in this book, we use BPR as business process reengineering.

An organization can realize dramatic improvements through radical redesign of its processes. This is in contrast to streamlining process in order to achieve a higher

level of performance. The above definition assumes that the existing processes are not sound and need to be replaced. A properly reengineered process can provide quantum leaps in performance and help achieve breakthrough in providing value to the customer. The common element that has to be noted is that, in a business enterprise, change occurs across whole processes.

1.6 BPR VISION

BPR vision is based on the future which is increasingly shared by enterprises around the world. It is evolving to include everything that existed about management in the industrial age and recasting it into an information age framework. This involves *shared information, mission support, reduced cost, reusable technology and just-in-time.*

1.6.1 Shared Information

Information is an important asset, which must be well managed to provide maximum return on investment. In the present information age, data management is becoming more and more important. Data is entered into the corporate database once and is maintained at the point of entry. It is made available wherever and whenever it is needed in whatever format and context, along with adequate security.

1.6.2 Mission Support

Data is captured and maintained in an organisation to support a defined mission. It helps in redefining business process in such a way that activities, which support mission, are strengthened and actions, which do not add value, are eliminated.

1.6.3 Reduced Cost

The activity that increases cost of business without providing additional benefits to the customer should be reduced or eliminated. Managers must search for these non-value adding activities and costs and eliminate them so that scarce resources can be optimally utilised.

1.6.4 Reusable Technology

There is a shift from custom developed unique management system to use of off-the-shelf technology and software to support standard business processes. This involves shift from custom developed engineering methods and life cycle project management controls.

1.6.5 Just-in-Time

Since information, training and support can be delivered electronically to the worksite at the precise time it is needed in the present information age, there is no scope for hierarchical compartmental corporations. These have to give way to horizontally structured enterprise organised around business processes.

1.7 BPR AND TQM

According to Grover, et al. (1995), TQM (total quality movement) and BPR share a cross functional orientation. According to Davenport (1994), quality specialists focus on incremental change and gradual improvement of processes whereas BPR has properties of seeking radical redesign and drastic improvement of processes. *Quality movement*, often referred to as *total quality movement*, or *continuous improvement*, refers to programmes and initiatives that emphasize incremental improvements in work processes. *Reengineering*, also known as *business process redesign*, or *process innovation*, refers to discrete initiatives which are intended to achieve radical redesigned and improved work processes in a bounded time frame. Figure 1.1 compares BPR with other change management practices.

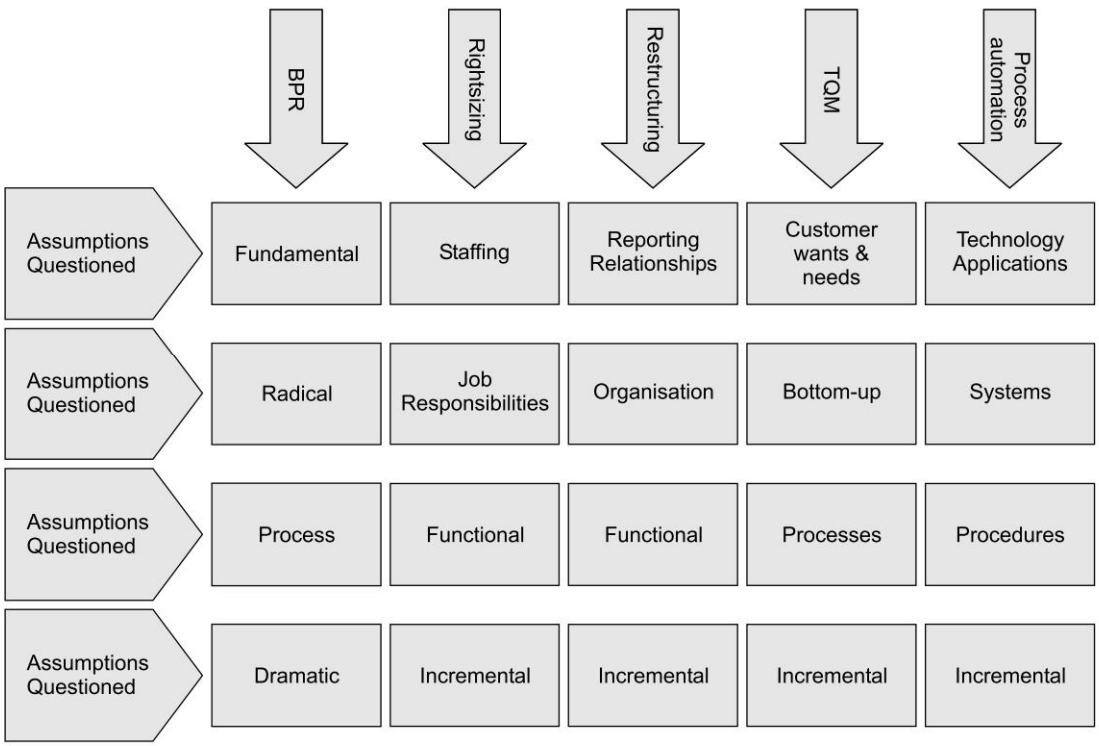


Figure 1.1 *Reengineering and the Rest*

1.8 BPR AND INFORMATION TECHNOLOGY

Information technology (IT) plays a very important role in business process redesign, though it may seem to be behind-the-scene activity. Information Systems (IS) groups have to develop a new set of basic values reflecting change in focus from technology to business processes and results. In other words, IS groups can act as partners in leading BPR initiatives.

According to Hammer and Champhy (1990), IT is the key enabler of BPR, which is resulting in radical change. He prescribes the use of IT to challenge existing inherent assumptions in work processes through the advances of computer and communications. According to him, the principles of reengineering are based on the following:

- Organize around outcomes, not tasks.
- Have those who use the output of the process perform the process.
- Subsume information processing work into the real work that produces the information.
- Treat geographically dispersed resources as though they were centralized.
- Link parallel activities instead of integrating their results.
- Put the decision point where the work is performed, and build control into the process.
- Capture information once and at the source.

According to Davenport and Short (1990), the relationship between BPR and IT is helping to fundamentally reshape the way business is done. They have a recursive relationship. If capabilities support business processes, then business processes should be designed in terms of what IT capabilities can provide. Table 1.1 gives a comparison of the various approaches of BPR.

IT can be a powerful tool for reducing costs of co-ordination in business processes. These can be in the following areas:

- Transactional
- Geographical
- Automational
- Analytical
- Informational
- Sequential
- Knowledge Management

Table 1.1 *Comparison of Reengineering Approaches*

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*
Reengineering Definition											
Business Goals as Starting Point	Y	Y	Y	Y	Y	Q	Y	Y	Y	Y	Y
Focused on Processes	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	L
Business/Process Goal Link	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Value Added Priority	Y	Y	S	Y	Y	Y	Y	N	Y	Y	Y
Customer Orientation	Y	Y	S	Y	Y	Y	Y	Y	Y	Y	Y
Radical Change Proposed	Y	S	Y	Y	Y	N	Y	N	Y	Y	Y
Extended BPR to Suppliers/Buyers	Y	N	N	Y	Y	Y	Y	N	Y	Y	Y
Appropriate Application	Y	Y	N	Y	Y	Q	Y	Q	S	Y	Y
Processes Addressed											
Single	N	Y	S	N	N	Y	N	Y	N	Y	N
Multiple	Y	Y	S	Y	Y	N	Y	Y	Y	Y	Y
Value Added	Y	Y	S	Y	Y	N	Y	S	Y	Y	Y
Support	Y	Y	S	Y	Y	N	Y	Y	Y	Y	Y
Methodology											
Described	Y	Y	N	N	N	N	Y	Y	N	Y	N
Adequate Detail	Y	Y	N	N	N	N	N	N	N	N	N
Use of Management Techniques	Y	Y	N	N	N	N	W	Y	N	S	N
New Process Vision	Y	N	N	N	N	N	Y	N	N	Y	N
Technical Design	Y	N	N	N	N	N	N	Y	N	S	N
HR Design	Y	N	N	N	N	N	N	Y	N	S	N
Addresses Barriers to Change	Y	Y	N	N	N	N	Y	Y	N	Y	N
Implementation Method	Y	N	N	N	N	N	N	N	N	S	N
Role of Automation											
Initial Point	N	N	N	N	N	N	N	N	N	N	T
Enabler	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	T

Source: Hammer, Michael and Steven Stanton, *The Reengineering Revolution*, Harper Collins, US, 1995.

Legends:
1: Rapid Re
2: Adair and Murray
3: Currid and Company
4: Thomas Davenport
5: Hammer and Champy
6: Hunt
7: Johansson, McHugh, Pendlebury and Wheeler
8: Morris and Brandon
9: Nayak and Ketteringham
10: Tichy and Sherman
11: Tomasko
Y: Yes
N: No
L: Limited
S: Not Specified
Q: Quality Improvement as Objective
W: Limited to Workflow and Cycle Time Analysis
T: Technology not Addressed

- Tracking
- Disintermediation

Innovative uses of IT can lead the firm to develop new co-ordination intensive structures, which will enable it to reach co-ordination levels that were not possible before. This, in turn, can raise organizational capabilities and responsiveness leading to potential strategic advantages.

1.9 BPR: AN APPROACH FOR PROCESS MAPPING

Developing a radical design is a two-fold challenge—*socio-cultural challenge* and *technical challenge*. The *socio-cultural challenge* results from the severity of organisational changes that typically accompany successful implementation of BPR projects. They include changing the work unit from departments and functions to process teams, work scope from functional or departmental to cross-functional, job from simple tasks to multidimensional work, people's role from controlled to empowered, job preparation focus from training only to training and education, reward system from activity based to result based and organization structure from hierarchical to flat structures.

The *technical challenge* is due to the difficulty of developing a process design that differs radically from the current design. There are ground rules for developing radical designs, for example, start from a clean slate, take a fresh look, start from scratch, start all over again, abandon outdated rules, question fundamental assumptions, ask basic questions, think outside the box, design with no prior constraints, redesign where there are no sacred cows and investigate new paradigms. More specific redesign guidelines are: minimize process decomposition, consolidate activities, allow employees who process the job to deliver it as well, redesign for single source data entry and redesign for common databases that are remotely accessed through networking. At the process design structure level (i.e., process map), however, the most widely used technique is *observational analysis* (OA). The OA technique, which primarily entails altering the process structure via inspection, is normally used after mapping the current process with a graphical representation tool, for example, structured analysis and design technique (SADT) and SADT based functional and process techniques of integrated computer aided manufacturing. The OA technique has a set of options to redesign a process that includes eliminating non-value added activities (for example, redundant, rework and supervisory activities), simplifying activities, combining activities, increasing the concurrency of activities and automating activities. *Value analysis* (VA) is sometimes used with OA to numerically assess the relative utility of each activity using time, cost and

value criteria. In addition, simulation techniques are frequently used to evaluate the dynamic behaviour of alternative designs.

Employee empowerment is required in reengineering so that the employee, in ideal sense, may take charge of the whole process from end-to-end. However, for an employee to handle processing of additional activities, comprehensive training and education are required. These education/training requirements are used as input to the proposed approach. Figure 1.2 provides a model to show the input(s), output(s), control(s) and mechanism(s) of its major steps. A case example of a public firm is provided to illustrate the approach.

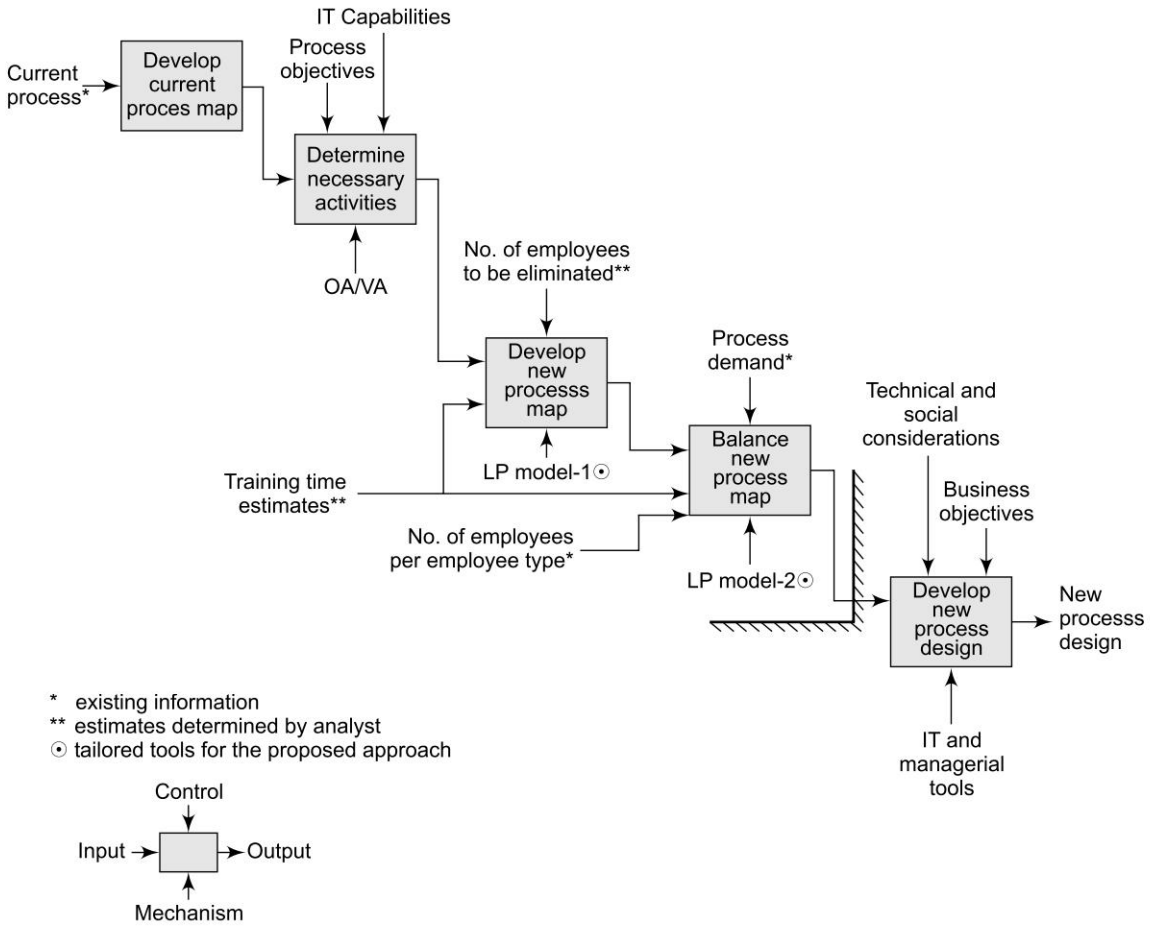


Figure 1.2 *A Model for Process Mapping*

1.10 OBJECTIVES AND COMPONENTS OF BPR

Traditionally, business engineering processes are concerned with the following:

1. Cost of doing business
2. Unit cost management
3. Continuous process improvement
4. Leadership

These are also required for BPR. But organizations must be concerned with elimination of

- Obsolete and inefficient processes
- Obsolete regulation and controls
- Unnecessary management overhead
- Lengthy review and approval cycles

Global business enterprises should be able to cost their products and services properly. When these costs are known, BPR principles can be used to reduce the cost of production, while improving quality and customer services at the same time.

BPR calls for continuous improvement. Even if a process is improved for now the manager cannot sit laid-back. He/She must be able to come up with a programme of continuous improvements. Leadership, of course, is critical to the success of BPR. Managers should be held accountable for BPR and also discretion with respect to BPR.

The major components of BPR are as follows:

1. Strategic/business planning
2. Activity modelling
3. Data modelling
4. Activity-based costing (ABC)
5. Economic analysis
6. Best business practices
7. Functional economic analysis (FEA)

1.10.1 Strategic/Business Planning

Strategic planning refers to a set of business goals and requirements expressed in terms of customer needs within the context of a mission, vision, values and beliefs. It will define values and beliefs—what the organization is all about, who it will serve, what needs it will fulfil and under what terms it will operate. A strategic planning should take into account the organizational constraints. In other words, the strategic planning should not be seen in conflict with mission, vision, values and beliefs.

Business planning provides a set of objectives with performance measurements and a detailed list of required output product and service features that will meet customer needs as defined in the strategic plan. While the strategy plan is concerned with identifying customers or customer requirements, the business plan focuses on satisfying the goals, needs and requirements expressed in the strategic planning process. It is also required, through this planning process, to identify and define information requirements necessary for proper development of information systems to support the organization's processes. This facet of business process reengineering planning is referred to as *business systems planning*.

1.10.2 Activity Modelling

It is a technique that assists in understanding how the business planning works. It is used to describe how things are—'As Is' Modelling—and also how the enterprise wants them to be based on redesigned criteria—'To Be' Modelling. Activity modelling requires that a business process be decomposed in a step-by-step manner into activities that make up the processes. This results in multi-level diagram, which corresponds to the way the work is done. The diagram shows the inputs, outputs, controls or constraints and the mechanisms or factors of production with respect to an activity.

1.10.3 Data Modelling

Data modelling is a technique that describes exactly what information is needed by an organization to perform the activities that make up the business processes. Similar to the activity modelling, in data modelling also an 'As Is' model describes the current data environment is produced followed by a 'To Be' model, which shows what data structures are required to be included to support the redesign process. It shows the entities (things or objects an organization values to keep data about) that exist when an activity is performed, the attribute (data items) of each activity and the relationship between and among entities.

Data modelling results in a clear delineation of business rules that constrain the way business functions and its processes work.

1.10.4 Activity-Based Costing (ABC)

ABC differs from traditional costing in the method of treatment of non-volume related activities, i.e. GAOH, procurement cost, etc. The benefit of ABC to manufacturing sector is due to the support services, which have grown substantially and are not volume related. For example, cost of procurement, set-up, maintenance of CNC and FMS systems, and quality control are non-volume related and are not recognized by traditional costing system. The ABC takes into account all these aspects. It has the potential to go beyond the distribution and absorption of non-volume related fixed overheads. The case study on electrical lighting distribution company by Johnson and Kaplan (1987) highlights the potential of ABC.

1.10.5 Economic Analysis

When the principles of BPR are applied to an organization's business process, they result in a number of improvement opportunities. Also, there will be an alternative means of implementing process improvements. Economic analysis enables an organization to determine costs and benefits associated with alternative investment opportunities taking into account the life cycle characteristics of investments. It also presents the decision data in an equally valued currency, i.e., taking the time value of money into consideration as well as the risks associated with making future decisions.

1.10.6 Best Business Practices

A manager has to answer two questions about his areas of responsibilities:

1. Is this the best way to do it?
2. How do I compare with others who have the same responsibilities?

The first question is answered by using the techniques of 'best practices' and the second question by the techniques of 'bench marking'. These essentials have been derived from total quality management (TQM) movement.

1.10.7 Functional Economic Analysis (FEA)

It provides a methodology for analysing and evaluating management practices and alternative process improvement and investments. It gives a framework for exploring alternative opportunities for improving business processes using sound business case practices. Functional economic analysis (FEA) and traditional

economic analysis (EA) are similar. They evaluate economic feasibility of a project using classic economic analysis techniques. The primary difference lies in scope. Whereas EA usually covers a single initiative or information system, the FEA has a broader scope covering duties assigned to a group of organizations or individuals that work together to produce a common product or service.

1.11 PROCESS MANAGEMENT

Business processes and sub-processes provide needed product or service for a customer. These products and services are produced within process according to requirements, rules or constraints that are defined. Materials and information provided by suppliers help in building a process. Each process consumes resources. Terms like downsizing or restructuring mean that organizations are moving towards process management and away from hierarchical management. Process management includes familiar concepts like total quality management (TQM) or continuous process improvement (CPI), self-managed teams, Business reengineering and high-performance companies. Each of these aspects or organizational enhancement starts with 'business process'.

In process management, work is organized and managed as an end-to-end process instead of a sum of disjointed functions. Process management, when it is firmly rooted in a business enterprise makes real and lasting improvements. It can be defined as "*a philosophy of management that advocates an integrated approach to the management of an end-to-end process, including its lower-level activities, which produces a product or service for a given customer*".

As could be seen, this definition encompasses everything necessary to identify projects and deliver a quality product or service to a fully satisfied customer. Total customer satisfaction becomes the key for organizational existence and not the structure and rules. Performance is measured by how well the product or service is received by the customer and not how well the activity within the process is performed. If the process supports the mission of the organization, then by managing it, the organization's mission will also be achieved.

Process management evolves as basic process model and basic systems model. In the *basic process model*, flow of work is defined through an organization beginning with an external input and ending with an external output. In other words, the basic process model is a set of decisions and activities that are performed to transform a defined input into a defined output. The *basic systems model* gives the interrelationship between sub-processes or activities that together produce a product or service for a pre-defined customer. This also represents the level where the organization spends considerable time trying to improve. But the exercise should focus on the performance of the system as a whole instead of a single activity.

1.11.1 Process Management Model

A process management model has five parts:

1. *Mission* (which is the reason the organization exists)
2. *Customer* (who the organization serves)
3. *Product* (what the organization produces for the customer)
4. *Process* (the activities and decisions that are performed in the development of the product)
5. *Information infrastructure* (the management of information flow)

The concept is simple. If an organization does not have customers, it does not have a product and it will not need a process to produce the product. If the organization does not have the need for the process, eliminate it. Of course, this is all taken in the context of the mission of the organization, which defines the reason for an organization to exist.

1.11.2 Levels of Process Improvement

The levels of process improvement provide another way of looking at a business process. Even the largest organization has five or six core business processes and continuous improvement of these processes will allow the organization to be able to continue to perform its mission even when its resources are depleting. Three aspects of process improvement are possible:

1. New process design (process engineering)
2. Process redesign (process reengineering)
3. Continuous process improvement

New Process Design New process design is performed based on the change of mission or strategic plan or business plan. It would be required when a previously outsourced function is brought in-house. There is no baseline from which to work on new process design. However, bench marking can be critical for the success of the effort.

Process Redesign Process redesign implies significant change in output product service requirements. It may also be undertaken due to radical changes in financial resources availability. It impacts across organizational boundaries on external suppliers and customers. Hence, it is required that the process reengineering team must be cross functional and include members from all impacted organizations.

A corporate mission or statement or strategic plan helps an organization to identify business process. The next step is to identify customers and suppliers. Customers

determine products and services from which business processes profit. Suppliers provide the raw materials which the business processes will use in building products or services. There has to be an analysis of all activities that take place in the process, which are in the value chain between what it got from suppliers and what it delivers to its customers. Activities that add value to products and services should be strengthened and optimized and the activities that do not add value need to be reduced or eliminated.

Continuous Process Improvement Process improvement or continuous process improvements refer to those improvements that can be undertaken and supported by an organization with minimum impact on external suppliers, customers and other organizations within the functional area. The focus is on redesign, overheads associated with self-imposed controls and restrictions, elimination of non-value added activities, redesign of non-value added costs and optimization of available resources with respect to process and activity output requirement, to mention a few.

Summary

In this chapter, we have discussed the need for Indian companies to look at business process reengineering as a competitive strategic tool. We have defined reengineering, business processes and BPR. We have also given the linkages between BPR and IT and BPR and TQM. The chapter discusses the concepts of BPR vision. We have also looked at the major components of BPR as compared with a traditional business engineering process. The major components of BPR, namely strategic/business planning, activity modelling, data modelling, activity-based costing (ABC), economic analysis, best business practices and functional economic analysis (FEA) have been dealt with in detail. Process management, as it relates to a product or service has also been discussed in detail. Process management Model consists of five parts, namely mission (reason the organisation exists), customer (whom the organisation serves), product (what the organisation produces for the customer), process (activities and decisions that are performed in the development of the product) and Information infrastructure (management of information flow), and all have been discussed. New process design, process redesign and continuous process improvement, which form the levels of process improvement, have been discussed.

Review Questions

1. Why, according to you, is business process reengineering needed for Indian companies?
2. Define 'reengineering' taking an example of a manufacturing company in the Indian context.
3. Discuss business processes with respect to a company of your choice.
4. Discuss the relationship between BPR and IT and BPR and TQM.
5. What are the components of BPR vision?
6. What are the different factors which organizations should be concerned about while undertaking BPR?
7. What are the major components of BPR? Discuss each one taking examples from the Indian context.
8. How is economic analysis different from functional economic analysis?
9. What is process management? Describe the model from which process management is evolved.
10. What are the salient features of process management Model? Discuss what is meant by process reengineering and continuous process improvement.

Suggested Readings

Davenport, T.H. and J.E. Short, 'The New Industrial Engineering: Information Technology and Business Process Redesign', *Sloan Management Review,* Vol. 3.1 (4), pp 1–27, 1990.

Davenport, T.H., 'Reengineering: Business Change Mythic Proportions?', *MIS Quarterly*, pp 121–127, 1994.

Grover, V., S.R. Jeong, W.J. Kettinger, and J.T.C. Teng, 'The Implementation of Business Process Reengineering', *Journal of Management Information Systems*, 12(1), pp 109–144, 1995.

Hammer, M. and James Champy, 'Reengineering Work: Don't Automate, Obliterate', *Harvard Business Review*, pp 104–112, 1990.

Hammer, Michael and James Champy, *Reengineering the Corporation: A Manifesto for Business Revolution*, Nicholas Breakey Publishing, London, p 32, 1993–94.

Johnson, H.T. and R.S. Kaplan, '*Relevance Lost: The Rise and Fall of Management Accounting*', Harvard Business School Press, 1987.

Porter, M.E., *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, The Free Press, New York, 1985.

Saha, P., 'Developing Measures to Assess the Extent of Sustainable Competitive Advantage Provided by Business Process Reengineering', Ph. D. Thesis (Unpublished), *IISC*, 2000.

Tariq, A.A. and L.K., Gaffar, 'Business Process Reengineering an Approach for Process Mapping', *The International Journal of Management Science*, vol. 27, pp 515–524, 1999.

2

ENABLERS TO BPR

Learning Objectives

This chapter will help the reader in

- Understanding role of IT as an enabler to BPR
- Knowing about the integral system of BPR and IT
- Discussing various phases of role of IT in BPR
- Understand IT capabilities for Reengineering

2.1 INTRODUCTION

Business process reengineering (BPR) concerns fundamental rethinking and radical redesign of business processes to obtain dramatic and sustaining improvements in quality, cost, service, lead time, outcomes, flexibility and innovation. A group of related tasks that together create value for a customer is called *business process*. Common corporate goals are (a) customer satisfaction, (b) return on investment, and (c) market share. These require process inter-dependencies and system dependencies that are established through integration of various business processes. The basic objective in BPR is to develop integrated inventory management and logistics strategies and processes to ensure their implementation through procedures and systems across the company based on the business process. A business process can be identified as the type of commodity that flows through the system. For example, product development and its transformation into final product can be viewed as a process. BPR focuses on the whole process, say, starting from product conceptual stage to final product design. Process focus provides the opportunity to reengineer the process or radically reduce the number of activities required to carry out the process with the help of modern IT. New developments in IT, such as multimedia, image processing and expert systems, can be used to reduce the number of non-value added activities. Organisational restructuring, including job redesign, can be used to improve the delivery process of goods and services.

Process simplification is the first major step in BPR. Therefore, a process improvement team should be established with the objective to analyse the whole process and then to identify non-value added activities, such as storage and inspection, and eliminate them. Delivery process emphasises cross-functional performance rather than encouraging departmental optimisation and the consequent system wide sub optimisation.

The focus on innovative and strategic computer based information systems over the past decade has exposed the constraints imposed by traditional organisations and their methods. Many firms (especially larger ones) were designed to succeed in a business environment which no longer exists. Some of their processes may even have implicitly and awkwardly evolved rather than being explicitly planned.

In the face of unprecedented environmental changes and intensified competition, bureaucratic streamlining has failed to deliver sufficient magnitudes of performance improvement. Even the gains promised by the successful adoption of total quality management (TQM), activity based costing (ABC) and similar gradualist initiatives may be insufficient for contemporary survival. Radical rather than incremental changes are now often deemed necessary to realize the enormous potential of computers and telecommunications, and to succeed as a business.

The role of IT in reengineering can be viewed from two perspectives: (i) role of IT function (For example, Internet, Multimedia, EDI, CAD/CAM, ISDN), and (ii) role of the technologies themselves (For example, CD-ROM, ATM, fibre optics). IT has

played a vital role in the success of the overall reengineering initiative. Information management throughout the company should be encouraged to develop skills in computer aided systems engineering.

Realizing the importance of IT in BPR, an attempt has been made in this chapter to understand first the concept of BPR and its importance to improve the competitiveness of firms and second the role of IT in BPR. Finally, a framework has been presented that provides stagewise design of a BPR system. The organization of the chapter is as follows: Section 2 presents the concept of BPR. Importance of IT in BPR is discussed in Section 3. The relationship of information system's capabilities in BPR is discussed in Section 4.

2.2 CONCEPT OF BPR

Business Process Reengineering (BPR) may be defined as *the critical analysis and radical redesign of work flows and business processes to achieve dramatic improvements in important measures of performance*. Its distinctive focus is the process, *a set of logically related tasks performed to achieve a defined business outcome*. With BPR, both physical and informational aspects of processes are considered. In fact, it is argued that information processing work should be subsumed into activities which produce information.

Researchers explicitly advocate a management-led revolution to reengineer these processes. Instead of embedding outdated processes in silicon and software, Davenport recommends starting over. His dictum is *don't automate, obliterate*. Davenport takes a broader (and perhaps more realistic) view, promoting process innovation, which encompasses *the radical improvement of business process performance through the use of innovative tools and work designs*. Such comprehensive and desperate measures are difficult to justify unless an organization is in serious difficulty and must be dramatically overhauled. Even many of its proponents admit that BPR takes a firm on a risky journey with an unpredictable destination.

BPR assumes that competitiveness can be increased by doing things differently (radical operational changes) as well as by doing different things (new strategies). With reengineering, the focus typically shifts from production oriented specialisation to customer oriented integration. The generic goal is to ensure that organisational resources, such as materials, labour and data, are transformed into product, service and information outputs which are distinctly valued by internal or external customers.

Discontinuous thinking is at the heart of BPR. Managers are asked to consider their entire organisation as a collection of horizontal processes rather than vertical functions. The current value and potential improvement of each process is considered. This is consistent with quality management prescriptions of Edwards Deming* who

William Edwards Deming was an American statistician, professor, author, lecturer and consultant. He taught top management how to improve design, quality of the products, etc. through various statistical methods.

advocated total systems thinking. However, a return to first principles is imperative with BPR; it requires courage to ignore or even destroy the status quo. In contrast to recent orthodoxy, reengineering assumes that radical changes are both necessary and possible. It is common to establish stretch goals, which can only be achieved by challenging current business assumptions.

Managers must rethink what they want their organization to be and do, determine what their (potential) customers value, and then model their business to best meet these needs. Specific reengineering aims may include reduced costs, enhanced flexibility, faster response, improved productivity and/or higher quality products and services. Often the primary goal of a process or group of processes would be modified, for example, from cost efficiency to timeliness. In other cases, the number of *hand-offs,* each of which promote miscommunication and delay, may be dramatically reduced. Brainstorming about a particular process can lead to recommendations for varying degrees of change. Many processes are likely to be redesigned from scratch rather than being rearranged or fine-tuned. Those which fail to add sufficient value would be eliminated. The replacement of outdated processes with innovative ones is driven by the belief that the customer is a prized asset rather than a necessary evil. A recommended procedure for BPR is shown in Figure 2.1. The redesigned organisation would ideally evolve from a small set of value adding processes rather than a command and control hierarchy. For example, the product development *process* may span research and development, engineering, marketing and manufacturing *functions* of a firm. Multidisciplinary groups would work across traditional functional boundaries.

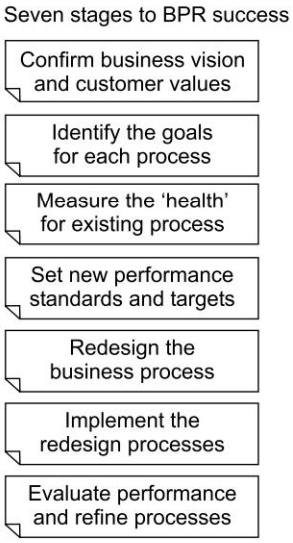


Figure 2.1 *Stages of BPR Success*

A conceptual model explaining the major elements of BPR is shown in Fig. 2.2. BPR requires organisational restructuring with the help of simplification and standardisation, and IT, such as Multimedia, Internet, MRP II, CAD/CAE, Electronic Commerce (EC) and Concurrent Engineering (CE). Organizational restructuring by standardization and simplification eliminates barriers for smooth flow of information and hence an efficient flow of materials along the supply chain. Smooth flow of information can be facilitated by use of various IT to improve integration of various functional areas. The basic aim of BPR is to deliver quality goods at competitive prices in a timely fashion. The manufacturing system as well as enterprise structure should be modified emphasizing simple coordination of basic business processes in the chain from suppliers to customers, as opposed to the existing complex structures of functional differentially hierarchies. Behavioural changes should precede reengineering of business processes. Therefore, issues such as training and education, employee empowerment, team work and incentive schemes play a major role in reengineering business processes.

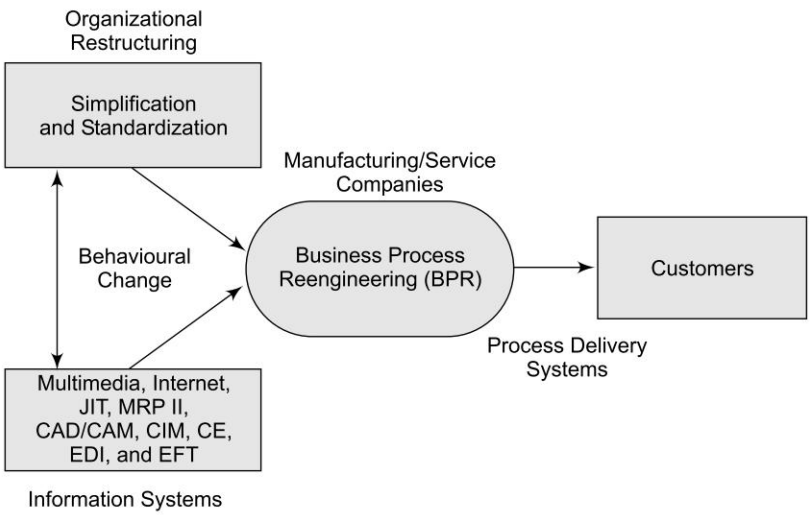


Figure 2.2 *Major Elements of BPR*

Business performance can be improved by mass customization as well as by simplification. This requires rapid development, flexibility in management and process based systems. In order to reengineer the business process, internal and external process capabilities, such as product development, production, distribution, suppliers and markets, and interorganizational relationship, especially in global manufacturing environment, need to be integrated. Also, this helps to achieve lean production through integration of production activities into self contained units along production flow. IT is an important element in such integration. The techniques, such as time based analysis, systems reengineering tools and IT, can

be applied to supply chain management as well as to customer administration cycle (order taking to cash collection), product design cycle (concept definition to product availability), human resource development cycle (skills need identification to training completion), and virtually every other process within an organisation. The appropriate handling of human motivational reactions to change is unquestionably as important in the successful introduction of radically new method of working as are the technical aspects of process design.

2.3 OLD WINE IN NEW BOTTLE

BPR has been cleverly marketed as a radical innovation which promises to rejuvenate firms battered by economic recession. However, its novelty does not come from its content 'what is new is the combination of elements in a well defined approach'. Executives contend that it is the integration of three core elements, IT, processes and transformation, rather than any fundamentally new idea which distinguishes BPR. A very popular expert in BPR, Davenport, suggests that reengineering combines the process management approach, which is common in Japan, with the western business focus on dramatic improvements, or innovations.

Flatter organizational structures and self managed work teams are claimed to be important reengineering outcomes, but both have been evolving themes for at least the past decade. Cross-functional teams were at the heart of both the *long wall mining system*, which increased production and morale among British coal workers after the Second World War, and the semiautonomous work systems used in Swedish and Japanese automobile industries by the 1970s. Thus, existing change management approaches are largely applicable to BPR initiatives.

Even the basics of process design merely extend ideas that have firm roots in industrial engineering, and its predecessor, scientific management. Scientific management emerged shortly after the industrial revolution. Its proponents argued that process efficiency could be maximised by dividing labour into localised, specialised and repetitive tasks and instituting organisational structures with detailed controls as well as management hierarchies. The increasing economies of scale in mass production were to sustain productivity growth. Akin to those on factory lines, office employees were soon asked to repeatedly apply their specialised skills to paper pushing.

Unfortunately, as a result of rapid technological progress, saturated and fragmenting markets, as well as a more educated and sophisticated labour force, many scientific management principles, such as task decomposition, job measurement and rigid hierarchies, have become obsolete. Task efficient workflows and fragmented expertise are poorly suited to meet customer demands for higher quality, greater innovation and better service. They also impede the realisation of synergies between business acumen and technical knowledge.

2.4 IT AS AN ENABLER

Although IT is not a necessity, it is a key enabler of BPR because of its capability to surmount both time and distance constraints. Communication technologies can increase the degree of collaboration while shared information resources (such as databases and imaging) can decrease the degree of mediation. Inductive thinking translates these technological possibilities into radical business improvements.

BPR strives to optimise IT use and facilitate a more natural and logical alignment between information systems (IS) and the organization. Remarkably though, the entrenchment of a new business process model can hinder both product innovation and further organisational changes.

Some cynics suggest that BPR is merely a self serving promotional mechanism for business professionals specialising in IT. Their arguments are bolstered by the fact that reengineering is a term closely associated with software development. Undeniably, BPR represents a shift from a cost constrained to a benefit realisation perspective of information technology. Electronically linked workers and even customers can quickly penetrate organisational boundaries and, subject to preset security restrictions, gain access to valuable data and expertise. This can facilitate more coordinated actions and enable decision making based on up-to-date information. The lean production techniques popularised by the Japanese automakers illustrate the power of combining advanced technologies and new organisational structures. Implemented computer based applications for enhancing service quality have traditionally lagged far behind technological advances. Misuses of technology have frequently ossified existing behaviours. BPR unleashes many potential benefits of IT by eliminating unnecessary labour, enabling parallel processing, overcoming geographic distances and eliminating intermediaries. Furthermore, intertwining information processing activities with related physical activity makes it easier to capture data at its source. The pull of business needs usually combines with the push of technological possibilities to drive a BPR initiative. In an ideal case, a partnership between IS and managers of relevant processes is formed. The process orientation of IS and the change enabling role of IT commonly raise organisational profiles of systems analysts and technical specialists. Traditionally, they have facilitated cross-functional coordination in functional hierarchy. BPR gives them new roles.

2.5 CONTRIBUTION OF IT IN BPR

In this section, we discuss advances in Information Technology, IT in BPR, IT Capabilities and Reengineering in the context of BPR.

2.5.1 Advances in Information Technology

Advances in information technology have radically changed the requirements of distributed systems. The advances of technology in the personal computer have redefined the

office environment and created a growing need for open, standard based, structured cabling schemes designed to handle traffic generated by the networks, independent of where they are placed. This helps to reduce overhead by allowing some employees to work from home or at remote locations where costs are low. Moreover, advances in financial and other business data have enabled application of advance management techniques using IT. *Manufacturing companies will gain production and sales opportunities more than the current Internet production and marketing once the companies are equipped with Multimedia communication systems, to send and receive audio, video and data.* Multimedia have enabled cross-functional decision making in a way similar manner in which related technologies of voice mail, electronic mail, software facilitated meeting processes and video conferencing enabled and improved communication.

Some of the most useful technologies that are widely being used, for example Multimedia, Internet, www, CAD/CAM, etc., as they are powerful in integrating the various functional areas in BPR. IT is used as a main source of reengineering tools to restructure the organisation and facilitate a cultural change with an objective to reduce the barriers between various functional areas of manufacturing.

IT helps to improve communication between various functional areas about company goals and objectives. This would lead to cooperative supported work for improved productivity and quality. Also, IT can be used to integrate both hardware and software elements in an organisation that aim to reduce the lead time at various places in manufacturing organisations. The manufacturing sector has gained productivity through investment in factory automation and IT. However, automating the existing processes with IT may lead to more efficient way to do things wrong. Therefore, it is important that the operations be standardised and simplified before automation and implementation of IT to improve productivity and quality. However, IT can be utilised in the process of planning the reengineering of various business processes, such as process mapping and identifying non-value added activities, using simulation modeling and analysis.

In the following section, an attempt has been made to study the role of IT in BPR with reference to manufacturing.

2.5.2 IT in BPR

BPR and IT form an integral system in improving the performance of manufacturing companies. Basically, IT can save time and improve accuracy in exchanging information about company goals and strategies. It removes much of the human error inherent to complex and repetitive tasks. IT saves money because it reduces errors and time taken to accomplish tasks. It provides competitive advantage by helping the company's market position and capitalises on trends so that the company should be the first to market a new product.

Electronic Data Interchange (*EDI*) is usually defined as the computer-to-computer exchange of relevant business data and is a set of agreed upon standards that make

transfer possible. It is not a common channel. Typical information exchanged might initially be orders and invoices to suppliers. Additional software advances may help to send order acknowledgements, order notices or electronic funds transfer (EFT). In this form, IT is simply automating an existing process. Therefore, EDI should be looked upon as an opportunity to change/eliminate intermediate processes. The objective of simplification and integration before automating is forgotten all too frequently. While EDI used to be expensive and complex, recent advances in packaged software, bar coding and telecommunications technology have made EDI affordable to businesses of all sizes. EDI and EFT enable a retailer to electronically conduct such functions as issuing purchase orders, paying invoices and processing credit checks. More importantly, EDI is the cornerstone of an effective and continuous replenishment/quick response programme, which electronically ties vendors to retailer's sales and inventory data to ensure that replenishment is coordinated as closely as possible with sales rates. EDI eliminates the barriers between functional areas, and within each functional area, for a smooth and reliable information flow. In addition, all non-value adding activities are eliminated by avoiding congestion in different functional areas through EDI.

In companies, internal communication is as important as outside communication. For example, networking the computers in a company and installing electronic mail system allows employees to send and receive messages among themselves. Also, programmes, such as NetScape and World Wide Web (www), facilitate access to other business sites for retrieval of useful data. Such information helps companies to compete successfully in the global economy and bring new products to the market by making major capital decisions based on more accurate and reliable information. Therefore, advances in IT and the need for making important investment and operational decisions require that computer based tools are linked with various business processes. For the success of BPR in manufacturing/service industries, it is important that IT help to increase the competition base through easy access to global suppliers on databases. Effective integration of various functional areas requires speeding up information flow in a business environment. The lead time for information flow has come down drastically through the use of advanced IT, such as e-mail and fax. The availability of cheap computing power and customisable software, and working in rapidly shrinking number of international or industry focused data formats has increased the pace of EDI implementation. In the last decade, MRPII evolved primarily from materials requirements planning system into something more fully integrated, with the inclusion of both the plant floor operations and the larger concerns of the enterprise, including the customer.

The encompassing network of manufacturing software systems has led enterprise to multiple systems, as well as to systems for logistics and supply chain management. A conceptual model is presented in Figure 2.3 to illustrate the role of IT in BPR. As noted earlier, the process has been defined from different perspectives depending upon the characteristics of the business and the strategic goals of the company.

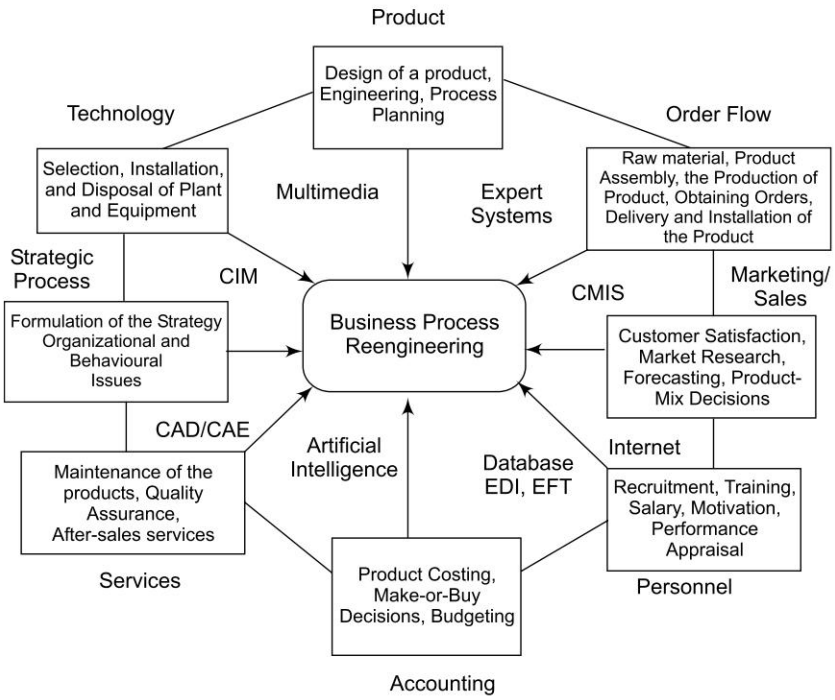


Figure 2.3 *Role of IT in BPR*

Nevertheless, the definition of process in a company has tremendous significance in influencing system performance and subsequent activities related to reengineering. The process definition used here is broad in context, including delivery of goods to customers, development of a product, purchasing, recruitment, strategy formulation, technology development and installation. The details of the model are discussed in the following paragraphs. The conceptual model shown in Figure 2.3 illustrates the role of IT in BPR and the major processes involved. These major processes have been identified based on critical areas of manufacturing/service industries. The recent literature on improving productivity and quality indicates that a need to integrate various functional areas with the help of suitable IT. From the model it can be easily noted that product, order flow, technology, delivery of goods to customers, marketing/sales, strategic processes, service processes, support services, accounting, and personnel form part of major business processes. For example, treating product development as a design process requires design of the product, engineering and process planning. Reengineering product development requires analysing the issues of strategic process, personnel, accounting, services and technology to achieve a dramatic improvement through a radical change, say treating the business process as a project.

2.5.3 IT Capabilities and Reengineering

The shift from mainframe to PC based technology is breaking down communication barriers between employees and customers. Now managers and employees from various departments are designing and controlling complex business information systems. IT capabilities involve improving information access and coordination across organisational units. IT is so powerful that it can actually create new process design options, rather than simply support it. In his book, *Business @ the Speed of Thought,* Bill Gates argues that if 1980s were about quality and 1990s were about reengineering, then 2000s would be about velocity. Gates advocates complete digitalisation of all aspects of life. He argues that to be successful in the digital age, companies need to develop a new digital infrastructure similar to the human nervous system. This new digital system enables companies to run smoothly and efficiently, makes them respond quickly to emergencies and opportunities and provides a means for quickly getting valuable information to people in the company who need it. This, in turn, empowers employees to make decisions and interact with customers. *What is the relation between BPR and Information Technology*? Executives practicing in BPR argue that BPR requires taking a broader view of both IT and business activity, and of the relationships between them. IT capabilities should support business processes, and business processes should be in terms of the capabilities IT can provide. They believe IT's promise and its ultimate impact is to be the most powerful tool for reducing the costs of coordination. It has been argued that innovative uses of IT would inevitably lead many firms to develop new, coordination intensive structures, enabling them to coordinate their activities in ways that were not possible before. Such coordination intensive structures may lead to strategic advantages. IT roles can be categorised into three phases: before the process is designed, while the process design is underway, and after the design is complete. Table 2.1 provides a summary of IT roles in initiating and sustaining BPR.

Phase 1 **Before the process is designed** (as an enabler): BPR is a strategic action and requires a clear understanding of customers, market, industry and competitive directions. Furthermore, like any other strategic action, it requires consistency between the company's business strategy and vision. Defining business strategy and developing a strategic vision requires understanding the company's strengths and weaknesses, and the market structure and opportunities. The activities in this phase may include:

- Developing a strategic vision
- Identifying the customer's objectives
- Establishing goals/targets related to market share, costs, revenue enhancement, or profit margins
- Assessing the potential for reengineering

Table 2.1 *Role of IT in Executing Reengineering*

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

- Defining boundaries and scope of appropriate process
- Keeping management committed

IT capabilities can provide good insight into the existing conditions. IT is one of several enablers, including human resources and organisational change. All must be considered together to bring about change in business processes. Many companies ignore IT capabilities until after a process is designed. An awareness of IT capabilities can and should influence process design. It is recommended by experts that companies redefine the process first and automate it second. IT can play an important role in this phase of BPR efforts as follows:

1. IT provides an opportunity is to utilise newer and better technology to develop strategic vision and help improve the business process before it is designed. For example, an important Wal-Mart vision was to eliminate unnecessary distribution steps and costs, and provide value to customers. To accomplish this, Wal-Mart developed a strategy that included linking its suppliers to its retail stores. IT eventually enabled Wal-Mart to implement this strategy. An enterprise wide information system was developed that directly connected all retail locations, distribution warehouses and major supplies.
2. The capabilities of IT to track information and breakdown geographic and organisational barriers are useful in understanding the company's strengths and weaknesses, and market structure and opportunities. Thus, communication technology enables broader acceptance of process change. At General Electric, e-mail systems are used for speed analysis, design sharing and hold frequent virtual meetings between groups from different regions and also overseas.
3. The focus is on finding different approaches to manage the process. These approaches can be found and adapted from practices of companies outside of industry. The organisation should benchmark against other industries and combine it with experience and expertise of its team members to adopt an entirely new process technology.
4. BPR requires a flexible organisation design. The existing rigid infrastructure should be altered to facilitate cooperation between various departments by using cross functional teams instead of individuals working in isolated departments. Flexible infrastructures adapt to changing external drivers. Therefore, flexible infrastructure includes processes for continuously evaluating existing tools to see what should be removed, and continuously seeking user input about what works or does not work.
5. To achieve effective teamwork, each worker should develop several competencies. The IT organisation is no exception. The demand for close collaboration with other functions dictates the need for IT staff to broaden their portfolio of skills, especially in non technical issues such as marketing, customer relationships, etc. The combination of the Internet and the Intranet services allows a collaborative team effort from around the globe.

6. Alliances and other methods of cross company coordination are becoming common-place. In an attempt to gain market shares, many firms are teaming and collaborating with suppliers and distributors.

Phase 2 **While the process is being designed** (as a facilitator): This stage involves two activities: technical and social design. During the *technical phase*, information is consolidated, alternatives are redefined, process linkages are reexamined and controls are relocated prior to applying technology. *Social design* focuses on human aspects and involves employees who affect corporate changes: defining jobs and teams, defining skills and staffing needs, and designing incentives are considered carefully. This stage also requires development of test and rollout plans. After the objectives are identified, the existing processes are mapped, measured, analysed, and benchmarked, and then are combined to develop a new business process. Development of people, processes, and technology are integrated. During process design, accountability for development, testing and implementation must be clearly defined. Real benefits to the business result when IT becomes involved with more fundamental changes to the business process itself. The crucial roles that IT plays in this phase of BPR efforts are discussed below.

1. IT can facilitate reengineering design process through the use of project management tools. These help identify, structure and estimate BPR activities and help to control contingencies that arise during the process. Project management tools, along with electronic communication, enable ongoing communication of the reengineering process between users and facilitators.
2. Gathering and analysing information about the performance and structure of a process is an important step in identifying and selecting the process for redesign. Mapping or flow-charting the existing process and then measuring the results in terms of cost, quality and time are the most successful. IT can facilitate this step with the use of tools that provide modeling and flow simulation, document business processes, analyse survey data, and perform structuring evaluation. Technologies, such as computer aided systems engineering (CASE), are designed primarily to draw process models. The ability to draw models and make changes rapidly speeds redesign and facilitates the process of process design. At Xerox, for example, several divisions are moving directly from process modeling to automated generation of computer code. They report high user satisfaction and improved productivity with the resulting systems. In addition, IT is capable of storing and retrieving unstructured, multimedia information that can be useful for developing process prototypes. The maintenance and operating workers at Union Carbide's plant in Taft, Louisiana used flow-charting to redraw their old process and create new ones. The results were a saving of more than US$ 20 million.

3. Computing technologies have facilitated a process oriented approach to system development where a database is shared in different functional units participating in the same business process. Ford Motor Corporation, for example used databases in its accounts payable process to cut down many intermediate steps, and to overhaul a sequential flow of paper documents among involved functions. As the project progressed, reengineering efforts achieved 75% reduction in the workforce. In addition to shared databases, imaging technology has facilitated a process oriented approach because in processing loan applications, for example, the digitised image of an application can be worked on by several employees directly.
4. Telecommunication technologies, such as LANs, groupware, etc., have improved collaboration among personnel of different functional units in their efforts to accomplish a common business process. At Texas Instruments, for example, the process for new product development was dramatically improved when a design team in different countries used global network to work on design directly without sequential flow of documents. As a result, the development cycle time for various products decreased substantially (more than 30% in some cases). At Ford, the process for new car design was improved when computer aided design (CAD) systems were utilised. Members of design teams shared a common design database across the Atlantic to exchange design ideas, criticism, and opinions without meeting face to face.
5. Making data digital from the beginning can provide a whole range of positive results. When figures are in electronic form, employees can look at them in any detail or in any view they desire, can study them and pass them around for collaboration. For example, Seven-Eleven Japan used IT to not only improve inventory control, but also provide key information to management and improve quality of sales information to make better operation decisions on a regional basis. In 1979, the company established an online network and introduced the Electronic Point of Sale (EpoS) system in 1982. At Hewlett-Packard Co, the sales process improved drastically as 135 sales representatives were trained to use laptops to retrieve up-to-date inventory information from the corporate database during customer meetings. In addition, sales persons used these laptops to communicate with their peers and superiors. As a result, time spent in meeting decreased by 46%, travel time was cut by 13%, time spent with customers increased by 27% and sales rose by 10%.
6. Input from employees and information on customer requirements is essential in reengineering. IT applications allow organisations to build a data base to track customer satisfaction, analyse complaints and obtain employees' feedback on ways to improve customer satisfaction. At Frito Lay, each of the 10,000 salespersons uses a handheld computer to record sales data on 200 grocery products, reducing many clerical procedures. The data is transmitted

to a central computer, which, in turn, sends instructions (such as changes in pricing and product promotions) to all salespersons through their hand-held computers. This process greatly enhances collaboration between marketing and sales, and also makes weekly summaries and analysis available to senior managers.

7. IT capabilities are used for information exchange and improve inner organisational collaboration. For example, R.J. Reynolds Tobacco Co used EDI technology in conjunction with varied technologies of electronic commerce, such as document imaging with electronic work queues, to reengineer its accounts payable function.
8. IT can also be used to help identify alternative business processes. IT can help companies to achieve multiple objectives in redesigning processes. Expert systems and technological databases can provide information on current and future capabilities of technology, human resources and organisation change. American Express improved quality, cost and time of its credit authorisation process with an 'Authoriser's Assistant' expert system. The successful redesign led to 25% reduction in the average time for each authorisation, 30% reduction in improper credit denials and 7 million annual reduction in costs due to credit losses. IT makes it possible to develop much richer processes.

Phase 3 **After the design is complete**: The bulk of the reengineering efforts lie in this phase. The reengineering efforts include planning and managing people, processes and technology, and driving implementation towards business vision. The objectives of this stage are to pilot test the new approach, to monitor the results, and to provide extensive retraining of employees. As reengineering efforts go forward it is important to define and redefine performance goals and objectives, maintain a strong commitment to vision, break the barriers between the departments and be flexible as the business environment changes. IT can facilitate the following processes in this phase:

1. Implementation of the new process through the use of project management and process analysis tools. These help identify structure and estimate all associated activities. They facilitate tracking and managing employee's expectations against commitments. Contingencies and problems that arise during the implementation phase can be handled and controlled.
2. Electronic communications enable ongoing and real time communication of the process between users and facilitators. IT helps to overcome geographic barriers.
3. Evaluating the potential investments and returns of the reengineering efforts is absolutely essential. How can the value of any specific reengineering process in the company's operations be objectively questioned? The reengineering team or the management should have enough information to determine

the value the new process contributes to the overall performance. Pacific Bell developed *process value estimation* (PVE) methodology to compute the amounts that were value added by a given process before and after the BPR effort. Pacific Bell management is using the methodology to target the 'right' process for reengineering, evaluate the changes that have been made and also the returns of the reengineering efforts.

4. A fundamental source of difficulties is the fact that processes are reengineered but infrastructure is not. The rigid infrastructure of the organisation must be altered to facilitate cooperation and to cross functional barriers between departments. Cross functional teams must replace individuals working in isolated departments. Recently, there has been a significant growth in collaborative computing products. These range from software for conducting meetings online to complex programmes that enable a number of users to collaborate in real time, sharing documents, managing projects and handling different tasks. These include idea generation, brainstorming, group outlining, voting, teleconferencing, meet-me-service, etc.
5. As other business divisions undergo the reengineering process, the IT organisation should be improved to meet their increasing needs. For example, in 1993, CIGNA implemented reengineering of its 1000-person IT department, CIGNA Technology Services (CTS). The main reason was to meet the increasing needs of its business divisions. A team-based structure resulted, and the benefits included a major change in the philosophy of the unit. Whereas the unit was previously technology focused. Management style changed from control based and functional, to leadership based and team oriented. The hierarchy was flattened, increasing flexibility.
6. *Digital feedback loop* provides a specific definition of success, a specific beginning and end in terms of time and tasks, intermediate milestones and finally a budget. IT is only useful if it helps employees do their work better and differently. Organisations are not working with the employees in the organization to infuse technology. Successful reengineering requires that companies first concentrate on crucial business processes that affect competitive factors, customer service, cost reduction, product quality and time-to-market. Obtaining greatest benefit from IT requires that the current processes may not be simply automated or the existing automation be only improved.

Many companies considered reengineering to be the productivity breakthrough of the 1990s. American businesses spent more than US$30 billion on reengineering projects in 1994, and as much as US$50 billion in 1995 and 1996. Reengineering efforts have produced a wide range of results. Some users achieved large cost reductions, higher profits and throughput, etc. In many of these firms, IT played

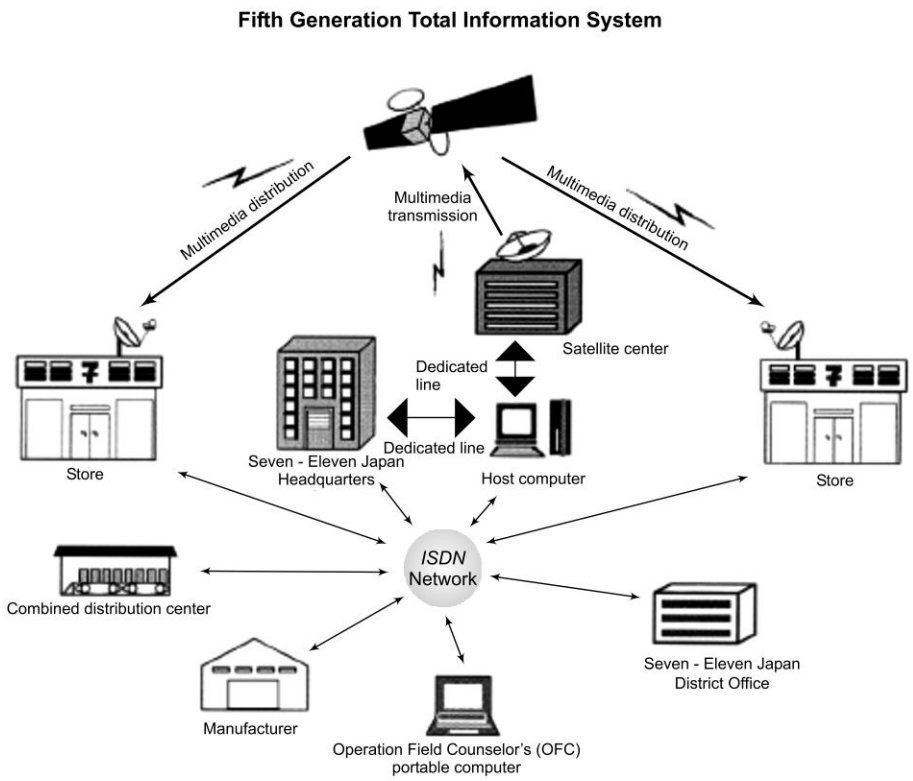


Figure 2.4 *Mohsen's Total Information System*

an important role in process redesign. Many innovative IT applications stem from a combination of breakthrough ideas and modification of the ideas that have succeeded or failed in other companies. Figure 2.4 gives a model of the total information system.

Summary

BPR is important for organizations to improve their competitiveness. This chapter presented the concepts of BPR, importance of IT in BPR and the relationship of information system's capabilities with BPR. BPR and IT form an integral system in improving the performance of manufacturing companies. Role of IT in BPR can be categorized into three phases: before the process is designed, while the process design is underway and after the design is complete.

Review Questions

1. How is radical process innovation related to information technology? Justify your answer by giving an example of a company of your choice.
2. Does IT contribute in organisational change? Explain.
3. Do you think a proper strategy is needed for successful implementation of information technology?

Suggested Readings

Attaram, M, Exploring the Relationship between Information Technology and Business Process Reengineering", *Information & Management*, vol. 41, pp 585–596, 2004

Gunasekaran, A and Nath, B, 'The Role of Information Technology in Business Process Reengineering', *Int. J. Production Economics*, vol. 50 , pp 91–104, 1997.

Martinsons, MG, 'Radical Process Innovation Using Information Technology: The Theory, the Practice and the Future of Reengineering', *International Journal of Information Management*, vol. 15, No. 4, pp 253–269, 1995.

Whitman, ME, 'IT Divergence in Reengineering Support: Performance Expectations vs Perceptions', *Information and Management*, vol. 30, pp 239–250, 1996.

3

BPR AND INDUSTRIAL ENGINEERING

Learning Objectives

This chapter will help the reader in

- Understanding the basics of industrial engineering
- Appreciating the difference between classical industrial engineering and BPR
- Understanding the relevance of BPR
- Reviewing the key elements of BPR
- Understanding the tools and techniques of BPR

3.1 INTRODUCTION

This chapter discusses the basics of industrial engineering, differences between industrial engineering and BPR. It also discusses the relevance of BPR using BPR's key elements, tools and techniques. It heavily draws from an article by R P Mohanty in the journal *Work Study*.

Industrial Engineering is a branch of engineering that deals with the creation and management of systems that integrate people, materials and machinery in productive ways.

Harold Bright Maynard has defined industrial engineering as: "Industrial engineering is concerned with the design, improvement and installation of integrated systems of men, materials, equipment and energy. It draws upon specialised knowledge and skills in the mathematical, physical and social sciences, together with the principles of methods of engineering analysis and design, to specify, predict and evaluate the results to be obtained from such systems".

Industrial engineering is also synonymous with operations management, systems engineering, production engineering and manufacturing engineering, or manufacturing systems engineering, a distinction based on the viewpoint or motives of the user.

While most engineering disciplines' skills are applied to specific areas, industrial engineering is applied in virtually every industry. Examples of use of industrial engineering include shortening of lines (or queues) at a theme park, streamlining an operating room, distributing products worldwide and manufacturing cheaper and more reliable automobiles. Industrial engineers typically use computer simulation for system analysis and evaluation to make processes more efficient, make products more manufacturable and consistent in their quality and increase productivity.

3.2 NEW CHALLENGES AND THE EVOLUTION OF THE ROLE OF IE

In the last decade, the role of industrial engineering expanded significantly beyond its traditional support functions to include organizational leadership responsibilities in both design and integration of manufacturing and service systems. In case of manufacturing, these functions oftentimes included design and development of new hardware and software that enabled automation of many production and support functions, and integration of these functions within operational environments. With many manufacturing environments now comprising complex arrays of computerized machines, design and integration of information systems that could effectively control and handle data related to product design, materials parts inventories, work orders, production schedules and engineering designs have become growing elements in the role of an industrial engineer.

Sophisticated tools used to analyse problems and design systems, that are now part of industrial engineering toolkit, have been applied successfully in service activities, such as airline reservation systems, telephone systems, financial systems, health systems and many other non-manufacturing environments.

The present era requires that industrial engineers increase their role in strategic planning and management control areas and lessen their involvement in operational control due to the following reasons:

- Operational control, including data acquisition, has become more automated
- Strategic planning, including entrepreneurship, would continue to increase in this era

3.3 INDUSTRIAL ENGINEERING IN THE GLOBAL CONTEXT

A recently developed definition of industrial engineering that reflects the new global economy more accurately states: *Industrial engineers integrate people, technology, and information to enhance a globally competing enterprise. Integration refers to the ability to understand the need for looking at the broader system and scope and not focus on individual problems.* Most engineering disciplines fail to do this.

Focus should be on improving production systems (manufacturing, hospitals, airlines, etc.). Analyses of all production systems require similar training, tools and knowledge and all must perform at highest possible efficiency, produce best quality and at least cost, especially in a globally competitive enterprise. In general terms, a production system is used to make products or provide services at competitive cost.

Generally, there is some input, for example, an order for a product, a patient needs an X-ray, or a customer orders dinner. We consider the production system to be a set of activities which are needed for a desirable output-finished product, completed X-ray or serving dinner to the customer. For the product, the system can be the manufacturing plant, for the X-ray, a clinic or a hospital, and for dinner, a restaurant. There are many subsystems in a production system. All production systems must operate at highest possible efficiency, lowest cost and highest quality. All industrial and manufacturing engineers actually work in a production system but they may be employed by a subsystem, say quality control or warehousing.

3.4 RELEVANCE OF BPR TO INDUSTRIAL ENGINEERING

The major economic forces affecting countries and organizations over the last decade have been *liberalization*, *privatization* and *globalization* (LPG). In turn, these have led to a number of influences and pressure on national economies. The most important among these is the power of:

- Customers
- Information
- Global investors
- Market place
- Simplicity
- Organization

The *power of customers* has been perhaps the most important factor shaping organizations. As a result, organizations have to continually learn, relearn and adapt to changing customers' choice, and requirement. This power compels an organization to move from bureaucratic mode to responsive mode of operation—to be flexible and lean, be able to meet customers' demands cost effectively.

The *power of information* (largely arising from advances in communication and information technology) can help an organization in the continuous learning and adaptation process. With the ability to transfer volumes of data globally from one organization to another, knowledge networking and knowledge management becomes possible.

The *power of global investors* offers a range of opportunities, no longer bound by regional or national boundaries. Organizations may also develop by sourcing materials and other resources from a much wider region.

The *power of the marketplace* generates fierce time based competition. This either motivates an organization to learn faster, to become better at providing quality and value, or it causes the complacent to fail.

The *power of simplicity* is the move to streamline systems and procedures within the organization and move away from a ritualistic culture to an empowering and autonomous structure. This involves reengineering/redesign of business processes and forging of organic partnerships to eliminate delays and bottlenecks.

The *power of organization* is the ability to use self knowledge, technology and modern business practices to change the shape of the organization. It is now possible to create much leaner, more agile organizations based on high performance teams.

In order to satisfy the needs of the customers and improve the performance of organizations, managers (often in partnership with consultants) have resorted to a variety of methodologies and techniques, including TQM, JIT, CIP, KAIZEN, BPR, etc. Some, like BPR, have been in existence for some time and have gone through a number of development phases (and sometimes simply repackaging). BPR has spawned business restructuring, core process redesign, business process management, business process improvement, business transformation, etc.

The attraction of BPR is that it can provide the means by which an organization is able to achieve a radical change in performance. This is achieved by simplifying

and streamlining major business processes, eliminating all redundant and non-value adding steps, reducing the number of stages/transfer points of work and speeding up workflow—often through the use of information technologies and systems.

The benefits of BPR may be simple and unidimensional, but are more likely to be complex and multi-dimensional. Often quoted benefits are improvement in the following:

- Financial performance
- Customer satisfaction
- Cost reduction
- Product/service quality
- Delivery performance
- Productivity
- Flexibility/responsiveness
- Process times
- Innovation
- Employee development
- Competitiveness
- Organizational flexibility

The BPR involves consideration of such fundamental questions as:

- Why are we doing it?
- For whom are we doing it?
- Where should we do it?
- How do we organize and operate in order to do it?

It has to be recognized that these are similar to the basic questions of method study of industrial engineering.

So, what is the difference between 'classical IE' and BPR? Is BPR more than a re-packaging of the old methodology?

3.5 CHARACTERISTICS OF BPR

Work that has been subject to BPR should:

- Be performed where it makes sense
- Be subject to minimal checking and control
- Involve single activities which were previously distinct and separate
- Focus on the process and not the functional activity

- Involve multi-dimensional jobs
- Be performed by empowered individuals and teams
- Be measured by outcomes and not activity levels
- Be lead by coaches, not traditional supervisors
- Take place within a flat structure
- Be managed by leaders, not scorekeepers

In other words, this is the outcome of holistic review.

3.6 NEED FOR BPR

The economies, and organizations within them, are experiencing same pressures for change every where, though, of course, with a particular 'spin' resulting from regional culture and history. Thus, there are changes in:

- Demographics
- Social values
- Economic environment
- Information technology available

These pressures lead to *four main imperatives:*

1. Manage costs
2. Improve quality
3. Improve service levels
4. Speed up actions

Although these sound simple, actual projects and change processes involve complex interrelationships between a number of factors.

Change projects involve:

- Structural dimension
- Management dimension
- People dimension
- System dimension

All this is taking place in (and as a result of) a transition from 'providers' market' to 'consumers' market' in which the battle for customers' business and loyalty is being fought on the basis of:

- Price
- Reaction time

- Quality
- Performance

Traditional organization structures (built as 'vertical silos') did have some advantages. The clear specialization and intense supervision meant that an organization could make extensive use of simple, uneducated, unskilled workers to accomplish most tasks. Everyone had responsibility for one limited aspect of the task; at the higher levels, (control of) the system was maintained through a bureaucratic chain of command. This advantage—the ability to exploit unskilled labour—was outweighed by the inherent inflexibility of those workers, and therefore of the organizations themselves. There was a natural tendency for no one person to take responsibility for the whole process, for errors to occur, and for the control bureaucracy to lead to long process times.

3.7 KEY ELEMENTS OF BPR

The reviewing processes, should involve taking a completely fresh look at all the elements that make up the process: the people, the management/leadership, the organizational structure and culture, the technologies—all in the context of the outcomes. What is the process designed to achieve?

People

It is axiomatic that people are the greatest asset to any enterprise. Too often, however, this is merely empty rhetoric. Companies that seek to create and pursue new paradigms, and attempt to remove functional barriers by redesigning process driven workflows, cannot hope to do so without the active co-operation of the workforce. The aim is to move beyond 'empowerment', to the development of truly 'renaissance' employees who can move from one business process development team to another, using their skills and knowledge to enhance the performance of any project (gaining increased satisfaction for themselves along the way).

Organizational Culture

The symbiosis of belief and value systems, and their interaction with and influencing of behavioural transactions, is the essence of organizational culture. The kind of organization that is more likely to succeed with a BPR initiative is one that already has a high degree of:

- *Inspirational leadership:* It can articulate a vision, drive values and create a harmonious climate in which business unit executives, managers and line personnel can all share commitment and flourish equally

- *Shared values*
- *Teamwork at all levels*
- *Connectivity between various stakeholders:* employees, shareholders, customers and suppliers
- Desire to dominate the market

Management and Leadership

Executives involved in BPR must take on the role of a builder. Reengineering demands new structures to replace existing non-responsive monolithic structures. This structural change must be accompanied by an appropriate culture. Changing culture requires a long term commitment, leadership by example and an understanding of the all embracing nature of culture. Changing culture is not for the fainthearted!

Organization Structure

The concept of a reengineered organization requires the structure to be closely related to, and underpinning, the cultural change required. This normally involves a shift from a mechanistic organization to an organic one (and it is such change that helps distinguish the BPR approach from the classical IE approach). See Table 3.1.

This kind of shift obviously has tremendous implications for human resource management and development, including the development of industrial engineers! They need to exhibit:

- **Systems thinking:** They must be able to take a holistic view, to integrate hard and soft information, to combine analysis and intuition, and balance the varied and multiple interest of the various stakeholders.
- **Inter-cultural competence:** It should be both within and without the local organization. As organizations become increasingly global and increase their dependence on other economies, an understanding of, and sensitivity to, different cultures becomes an important requirement.

3.8 PERFORMANCE INDICATORS

Since reengineered processes are transfunctional, most (previous) key performance indicators are inappropriate. Concentration on outcomes and on core processes actually simplifies performance measurement. Resulting measures should be clear and simple, such as:

- Quality
- Lead time
- Cost
- Service

Table 3.1 *Comparison of Mechanistic and Organic Models*

Mechanistic model (classical IE based)	*Organic Model (BPR based)*
Hierarchical and bureaucratic management	Flattened and shortened chain of command
Vertical division of labour Centralisation of most divisions	Decentralisation and devolution of responsibility and of decision making, and fixation of process accountability
Separation of categories by status (manual workers, office staff, managerial staff, etc.)	Blurring of status differences and trend towards more equal status: creation of multifunctional process teams
Atomistic analysis of work and division of labour	Enlargement and enrichment of tasks/trend towards a more professional division of work
	Concentration on core processes and outsourcing of peripheral/support activities
Strict compartmentalistation of functions and services	Close integration up and down stream between functions like research, development, production and distribution
	Concept of supply chain
Research, development, design and production functions are differentiated one from another—division and functional structures	Structures differentiated by product and product lines Concept of value chain
Specialisation and compartmentalisation of knowledge	Multi-disciplinary team working
Loose ties with suppliers	Connectivity with suppliers and subcontractors
Loose ties with consumer	Great sensitivity to market demand, to buyers and consumers, and all stockholders
Standardisation products and production processes	Structural, technological and organisational flexibility
Overall routines and rigidities	Flexible thinking
Formalised practices Structural inflexibility	Continuous search for innovation and added value
Production management is central	Human resources development is central
Conflict based industrial relations	Consensus based partnership

3.9 TOOLS AND TECHNIQUES OF BPR

The essential tools of BPR are the ones that are needed and exploited in a range of productivity and quality improvement methodologies. The chief 'technique'

(if only life and BPR were that simple) is to manage change. Change is invariably perceived as a threat to existing ways of working, and to job security. Industrial engineers, historically, have been *change agents*, advising on changes in methods, systems, procedures, etc. Their approach has been rooted in strong technical skills. If BPR is to be successful, the strong technical skills have to be married to a strong understanding of the needs of the customer (at all stages of the process) and the concerns and fears of those involved in the process. Systems analysis, value analysis, target costing, simulation, optimization, method study, organizational analysis, scenario planning, environmental scanning, cause-effect analysis, fault tree analysis, bench marking, etc., may all play their parts often simultaneously, but they should be in the context of the transformation of people's jobs, roles and place in society.

3.10 IMPLEMENTATION OF BPR

It is useful to categorise processes and activities according to their perceived (or real) value and the costs they consume. Low value added processes should obviously be removed or redesigned, especially if they are high cost. If, for some reason, it is not possible to eliminate them, a cost reduction exercise should be undertaken. Innovative approaches may be used for processes that deliver high value but at the same time incur high cost so as to change their ratio. Even processes that have high value and low cost should not be excluded from review: these may be the source of restructuring or re-investment to bring dramatic improvements in value. The aim is to achieve dramatic cost reduction, become 'best in class' and find *breakpoints*,—where the rules of the game are actually changed and 'the class' itself is changed. Others then have to emulate this new standard—clear evidence of superior performance in one or more value metrics clearly recognised within the marketplace, associated with any or all of:

- **Robustness:** The physical attributes of the product, in terms of its reliability, fitness for purpose, ease of manufacture and even its ability to be recycled.
- **Price:** All markets are sensitive to price to some degree as it can have a big influence on the market position. Occasionally, bold pricing decisions can change the nature of the market.
- **Lead time:** Lowering lead time affects manufacturing economics (less need to hold stocks) but, more importantly, allows greater responsiveness to changing customer demands. In some industries, it allows a move from 'build for stock' to 'build to order'.
- **Flexibility:** It relates to other factors. For example, flexible manufacturing processes allow synchronizing of capacity with customer usage and provide the flexibility to respond to mix variance.

- **Reliability:** Reliable products obviously have a market advantage. However, it is just as important to have reliable processes in which all activities are performed consistently within the designated schedule.
- **Product design:** Since processes are reviewed, the danger of divorcing design from manufacture is eliminated. The product design process must relate to customer desirable attributes and to 'manufacturability'.
- **Good service:** This involves an empathy with customers, and is delivered by well trained, competent, quality staff with appropriate knowledge, skills, confidence and right attitude. These staff are available and accessible at all 'reasonable' times. A real breakpoint leads to new finishing lines for competition and changes the rules of corporate Olympics!

Searching for these breakpoints through BPR may be considered in three phases.

Phase 1: Discover During this phase, the company analysis current performance. More importantly, it discovers its mission, values and strategic aims. Hence it identifies the core processes that add the required value. *It, in effect, decides what BPR must achieve.*

Phase 2: Redesign This is the major stage of innovation. Appropriate investigative and creative techniques, involving input from a wide variety of people are used. Ideas are generated and validated. It is here that any breakpoints are created. *This phase must end with a commitment to the change to be made.*

Phase 3: Realise The ideas now have to be translated into real results. This is often the hardest phase as it involves managing change, coping with resistance, leading into the unknown. There must also be a realisation that BPR is (hopefully) a revolutionary process supported by evolutionary activity. *The BPR exercise should try to create a culture and a facilitating framework for continuous improvement.*

3.11 EVALUATION OF BPR

BPR is a comprehensive change management programme. Too often, companies introduce such programmes in haste without proper preparation—perhaps following the latest management 'fad'. Although there may be an urgent need for transformation in organizations, most are not in a position to implement BPR. They mostly lack appropriate knowledge of basic methodologies and tools. Although they can import this knowledge by employing consultants, they are often too naive to enter fully into such projects with the commitment vital for success. Organizations are ready to implement BPR when:

- *They have an appropriate mind-set.* This arises from a combination of right values, structures and performance measures that can drive and support change through the existing authority structure of the organization.

- *There is a sense of urgency for abrupt change.* This may be necessary if the organization needs to redefine its business mission, shake up the existing power structure and/or delayer the existing senior management.
- *They recognise and want to emulate industry leaders.* This strategy can be used to bring about quick changes by identifying and following best industry practices (perhaps by benchmarking and other inter-firm comparisons).
- *They can direct efforts in multiple dimensions.* Organizations with very strong core competencies plan their BPR efforts across a broad set of fronts. They design it top-down, focusing primarily on a number of direct issues to generate the maximum immediate financial impact, and then move forward to indirect and support issues.
- *They can redesign systematically.* A major contribution to BPR is the systematic, planned intervention in which efforts are made to analyse, investigate and redesign, issue by issue, and then seek integration.
- *They can mobilise frontline, high performance action teams.* It is important to supplement top-down initiatives by promoting change by means of frontline problem solving teams.

Conversely, BPR is likely to fail when:

- There is no compelling imperative for change.
- There is a lack of involvement of most people in BPR because it is seen as just another management led initiative.
- Organizational power politics restrict inputs of those with important knowledge, or with a major stake in success.
- Managers are simply looking for a quick fix.
- There is insufficient investment in either IT, IS and/or HRD. No attempt is made to build the organization's capacity to sustain change and on-going improvements in the long term.

BPR, like IE, involves the application of scientific thought to the solution of organizational problems. However, BPR can be said to have a broader charter: *integration of knowledge throughout the organization as a source of sustainable competitive advantage.* The power lies not in knowledge but in the ability to use knowledge for the benefit of the stakeholders. BPR, by the very nature of its process orientation, requires executives to evaluate knowledge potential, interdepartmental cooperation and team working abilities. However, executives may not develop appraisal systems required to measure the so-called unmeasureables. Traditional measures used as the basis for appraisal will prove would seductive as well as deceptive. *Seductive*, because organizational development interventions are often conditioned to focus on financial returns and other outcomes, but not on processes to maximize value. *Deceptive*, because the limited ability to measure improvements in internal processes, often

relegates process issues to secondary importance. Summary Industrial engineering as a discipline has been around in a number of forms and under a number of titles for the last 50 years. It has primarily been concerned with:

- The pursuit of organizational efficiency through methods improvement and resource-saving
- Organizational reform through business, market and technology development

BPR today borrows its approach from the traditional IE. However, its aspirations are much higher. It aims, not simply at reform and improvement or at evolutionary change, but at the total transformation of the organization. IE is certainly not dead—BPR needs the important underpinnings of IE. It needs IE to maintain the results of the BPR exercise and to support the subsequent phase of continuous improvement.

Summary

During the last decade, industrial engineering gained significant importance as it focused on the broader scope of the organization. Most engineering disciplines apply their skills to specific areas whereas industrial engineering skills can be applied to almost every industry. To compete globally, industrial engineering integrates people and technology, which are the key elements for any organizations. This chapter discusses the relevance of industrial engineering in the global context. Challenges faced by industrial engineering are also discussed in this chapter.

In order to improve and measure productivity and performance, organizations use several tools, including BPR. BPR is also considered a change management tool and is used to study the impact of implementation of change. This chapter also highlights the tools and techniques of BPR and performance indicators used by the organizations.

Review Questions

1. Compare and contrast between industrial engineering and BPR.
2. Discuss the key elements of BPR.
3. How is the implementation and evaluation of BPR carried out? Cite examples from Indian organizations.

Suggested Readings

Maynard, Harold Bright and Kjell B. Zandin, *Maynard's Industrial Engineering Handbook,* 5th ed., McGraw-Hill Professional, 2001.

Mohanty, R.P. '*BPR*—beyond Industrial Engineering?', *Work Study*, Volume 47, Number 3, pp 90–96, MCB University Press, 1998.

4

STRATEGIC PERSPECTIVES OF BPR

Learning Objectives

This chapter will help the reader in

- Discussing the critical issues of strategy processes
- Understanding the link between BPR and strategy
- Appreciating the strategic role of business processes
- Discussing how process reengineering can be used to identify business processes
- Linking business unit strategy to business processes

4.1 INTRODUCTION

For many organizations, the crucial issue in the strategy process is implementation. This is due, in no small way, to the distinction that is traditionally made between formulation and implementation and their treatment as sequential activities. The more recent conceptualization of strategy, captured by the notion of core competencies, is blurring this distinction. This emerging 'behavioural perspective' of strategy focuses on the capabilities an organization needs. Yet, it still fails to address fully the issues of implementation. This chapter proposes business reengineering as a natural ally of strategy. It is suggested that business reengineering can help bridge the gap between strategy formulation and its implementation. In this context, business reengineering is seen as an approach that defines business architecture, enabling the organization to focus more clearly on customer requirements.

The dominant paradigm in relation to business strategy is of a rational analytical process through which the successful organization is enabled to adapt intentionally and systematically to its environment, so achieving its predicted objectives. The strategist, either top management or a separate planning department, conceives the strategic options open to the firm when changes occur in the external environment. This focus on formulation contends that strategic analysis and strategy development are the crucial drivers of success.

The top management formulates the strategy and the middle and junior management implements it. It has become the cornerstone of accepted management wisdom. Yet, case studies continually show that problems occur more with implementation than with formulation. *Implementation is about understanding strategic objectives and ensuring that an organization's operations, human and technological resources are contributing to the delivery of this strategy.* In this regard, it has been argued that strategic thinking has far outdistanced the capabilities organizations have in delivering sophisticated strategies. Recent writings have focused on internal strategic drivers and placed strong emphasis on operations excellence as the source of competitive advantage. This has been mirrored in the strategy literature with the notion of core competencies. These can be described as a combination of people, processes and technology blended together to secure competitive advantage. The notion of a process is also the cornerstone of business reengineering. This chapter discusses that business reengineering is the natural ally of strategy, particularly in relation to its implementation, and attempts to understand, develop, and make operational this link. This is an under researched area, mainly because it falls between two conventional disciplines one of which is very young and is still inward looking while the other is, older but has a distinct external focus. It is suggested that business processes serve as the means to realise business strategies and are the means to render strategies explicit and precise, facilitating their operationalisation. Without this link, neither business strategy nor business reengineering will achieve the benefits being sought.

4.2 FORGING A LINK BETWEEN BPR AND STRATEGY

Business strategy is a key issue for every major organization. Traditionally, formal strategic planning is conducted by establishing a vision and objectives and then a high level course of action to achieve these objectives. Over the years, this focus on planning has been somewhat modified with the term *strategic management* proposed as an alternative. Formal strategic planning is one component of a much more complex socio-dynamic process that brings about strategic change. To reach the pinnacle of strategic management, a company must have a sound strategic planning framework, a widespread strategic thinking capability, the right motivational systems and management values, and a good system for negotiation and review. Yet, this perspective barely addresses the issues of implementation, and we shall return to this later. The traditional focus of strategic planning has been to identify products to sell and markets where they should be sold, and the process of strategy formulation has tended to reflect this view. Even industry and competitor analysis sought to provide a framework to enable the firm to position itself in the industry in which it competed. This prescriptive view of strategy has been questioned on a number of issues, mainly on the implementation aspects. This is where BPR can come in as an admirable foil to strategy. With respect to functional and applied areas in the organization help in change management and sustaining that change. This can lead to sustainable cooperative advantage for the organization.

4.3 STRATEGIC BUSINESS PROCESSES

Business reengineering is concerned with changing an organization to reflect more what it does (For example, satisfy customer requirements) rather than what it is (For example, a manufacturer). Building on the earlier discussion relating to business strategy, we propose that there are two critical types of processes in organizations. These derive from the product and market focused element and the competency element of business strategy. First, organizations need processes to support their current products and services in the market place. These processes relate directly to an organization's current basis of competition. These processes, we call *competitive processes*. So, if we are competing on speed to market new products, the competitive processes would relate to this focus. If providing a prompt turnaround to customer orders, then the competitive processes would be the process that causes this to happen. If we are a low cost producer, our competitive processes would contribute to this stance, and hence the related processes would be of significantly lower cost than our competitors'. It is unlikely that a low cost strategy can be pursued by aiming to be significantly lower than the competition in every single area. Choice has to be made and the chosen processes are classified competitive processes. In 'economics speak', these processes enable the firm to enjoy 'super-normal' profits.

The *Grand Metropolitan* (GrandMet) approach to BPR is clearly focused on redesigning and supporting distinct competencies of the organization. They use BPR

to implement what they call *competence based strategy*. They distinguish this from the traditional *structural strategy* followed by many of their competitors which addresses issues like the composition of the product portfolio, market selection, logistics, acquisitions and divestments. GrandMet claims that such strategic decisions are easily copied by competitors. The competence based strategy deals with establishing excellence in the core competencies necessary to operate effectively in its chosen marketplace in the future. For GrandMet, critical competencies include such things as managing individual brands, product launching, market penetration and manufacturing and operational excellence. They are not readily recognized by competitors as key strengths, and they are neither easily nor quickly copied. But it is these competency based strengths that enable the company to react, adapt and prosper in such a volatile and competitive environment. Such capability was created some while ago by infrastructure processes. Look at the giant US mass retailer, Wal-Mart. On the surface, Wal-Mart is in the business of selling moderately priced goods to the public. But Wal-Mart took a closer look at its industry value chain and at its own comparative advantages and decided to reframe the competitive challenge. They concluded that the business they were really in was not retailing at all, but communications and transportation logistics. They then focused on redesigning and improving those processes which enabled them to catapult themselves to become the leading retailer in the US. The creation of necessary technology, people and processes was created by infrastructure processes some while ago.

On face value, ***Midland Bank*** might seem to make the first attempt to get into the home banking market. However, while this is undoubtedly true, on further analysis, it could also be looked upon as developing a capability to be the leader in building telephone relationships. Tele-banking is just one product group which they are currently offering, and they have a competitive process associated with the customer interface to support telephone banking. Is it not possible for them to offer other products in such a manner, for example, insurance or holidays? Have they not created an organization with a clear capability not only in banking, but in doing business over the telephone? The processes that created this capability were the infrastructure processes. Competitive processes support today's product and market based strategy. Current capability is encapsulated in competitive processes. Infrastructure processes create the capability for tomorrow's competitive processes and hence support tomorrow's competency based strategy. Together, we term these two critical types of processes, the *strategic diamond*.

4.4 STRATEGIC ROLE: CLASSIFICATION OF BUSINESS PROCESSES

The above analysis begs the question: What about other organizational processes? Observations suggest that organizations also have other processes which are critical

for the organization to function. There may be processes which an organization must have in place because of government legislation or stewardship, such as accounting and filing tax returns. Additionally, mundane tasks, such as recruiting secretaries and administrative staff, are important, but clearly, in the short term, good secretarial services are not the basis of competition.

This suggests that other processes exist and a classification of all these would complete the picture. We propose that in addition to the competitive and infrastructure processes previously discussed, two further process types exist: core processes and underpinning processes. *Core processes* are those processes that are valued by the stakeholder and hence must operate satisfactorily but are not presently the chosen basis of competition. They are necessary for the organization to avoid disadvantage in the market place and may be the minimum entry requirements into the market or perhaps necessary because of government legislation. For example, a vehicle scheduling process is vital to a logistic business but may well not be a chosen basis of competition and hence it is a core process to that organization. We are using the word stakeholder, rather than merely customer, to include customers, suppliers, employees, shareholders, government, etc. as the focus of core processes. All the processes necessary to satisfy the stakeholders are termed core processes unless they are the chosen bases of competition with customers, in which case they are termed *competitive processes*.

Underpinning processes are processes that are undertaken but are not recognized nor valued by stakeholders in the short term. Such processes exist in all organizations and are collections of closely related activities that are grouped together for efficiency and recognized as a process. In reality, they are not a 'real' process in the sense that they directly support customers but rather contribute to other categories of processes. A conscious decision is made to treat them as a separate process. One might ask why management should choose to treat them as a process. The answer exists in the benefits of functionalism, namely efficiency and specialization. In fact, one of the benefits of reengineering is questioning if these underpinning processes should be commonly organized or associated with the customer recognized process that they underpin. We have created this category of processes to allow for a management desire to jointly manage similar activities but are not suggesting that this is necessarily the most appropriate way to manage such processes.

For example, in the performance of competitive, infrastructure and core processes, some administrative support is probably necessary. The recruitment of these support staff may therefore be an element of a number of processes. For efficiency reasons, management may decide to combine this element and manage them as a single process. We term these single shared processes as underpinning processes. The four types of processes are illustrated in Figure 4.1. We term combination of competitive and infrastructure processes as the *strategic diamond* as they directly support business strategy. Infrastructure processes support the future competency

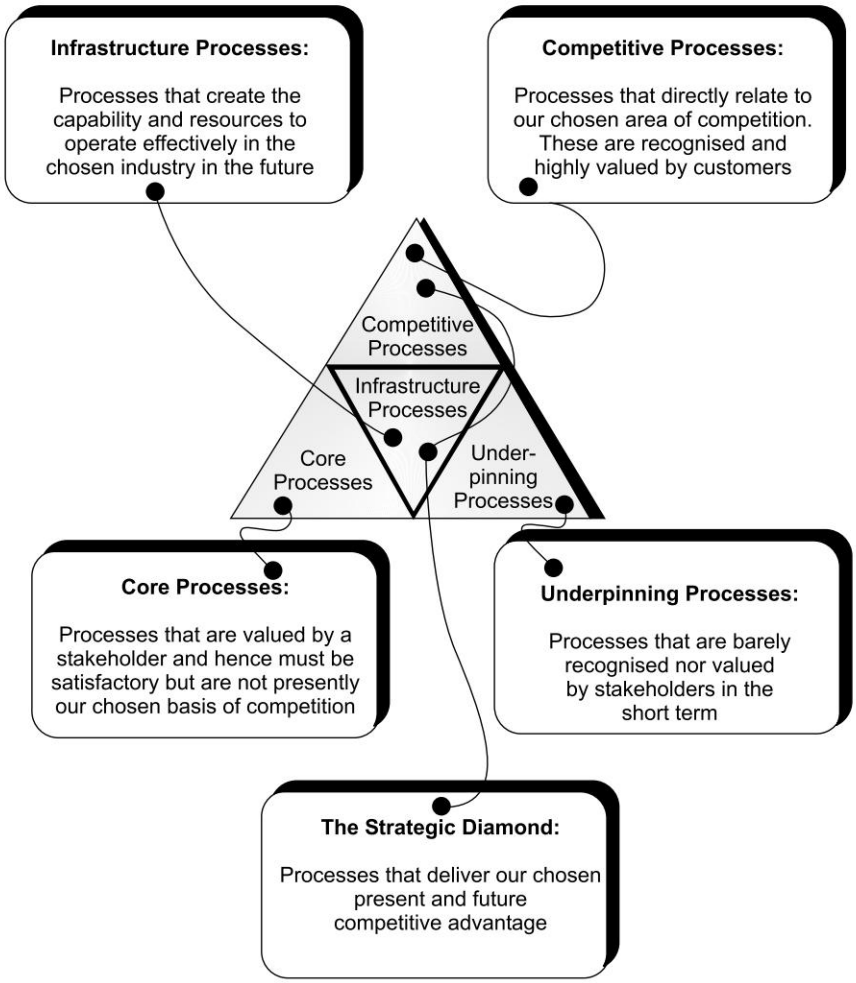


Figure 4.1 *The Process Triangle*

elements of business strategy and competitive processes support the market and product based elements of business strategy.

4.5 MIGRATING PROCESSES THROUGH TIME

This vision of processes presented thus far may appear very static, but, to be useful, it must take account of the changing contribution of processes through time. There are two major reasons why processes change their status through time. The first is related to a change in our business strategy which will have a consequential effect on the associated processes. The second relates to a change in competitors'

actions which may force us to reevaluate processes which are currently providing advantage. Let us now consider the major movements which may occur around the process triangle. Infrastructure processes are likely to remain stable over the longer term as capability is not something that would be generated in a short time and a continual changing of direction would be grossly wasteful.

Through a process of infusion, the process element output of an infrastructure process, namely *capability* (people, process and/or technology), becomes a competitive process. These infrastructure processes can be viewed as providing the 'fertilizer' which nourishes the organization's future capabilities. It must be borne in mind that the organization does have current capabilities of which the competitive and core processes are an integral part. The renewal of the current capabilities should have been designed into the core and competitive processes at the outset by the infrastructure processes when the organization was creating them. For example, the output of the management development process is a more skilled workforce along with the ability of that workforce to improve itself. Therefore, the infrastructure processes do support the notion of continuous improvement. Competitive processes may cease to be competitive and become core processes for two reasons. First, other players in the industry create processes that are as efficient, effective and adaptive as those which the organization is currently using. When this situation arises, there are a number of options open to the firm:

- It may try to redesign the process and achieve greater efficiency, effectiveness or adaptability, and hence maintain it as a competitive process.
- The business strategy changes to reflect this new situation and a new competitive process results. In the short term, the process, however, is still essential to compete in the industry and it must, therefore, continue to exist to avoid disadvantage and, hence, it migrates to become a core process.

Second, it may be that despite our lead we do not wish to continue to compete with this process and hence we re-classify it as a core process.

It is also possible for core processes to become competitive processes. For example, one of the products provided by a bank is cheque account. It can be used to pay bills and also to obtain cash from one's account during banking hours at one's local branch. With the arrival of Automatic Teller Machines (ATMs), the product remained the same but it radically changed the nature of the delivery medium (i.e., the process). Customers could withdraw cash at any of the bank's ATMs at any time of the day. Adopting this technology has become a competitive process. However, as competitors created similar processes, the advantage began to evaporate and it became a core process again. Today, banks must have an ATM network if they are going to compete in the retail banking market, yet which bank is gaining advantage from them? Figure 4.2 illustrates migration of business processes through time.

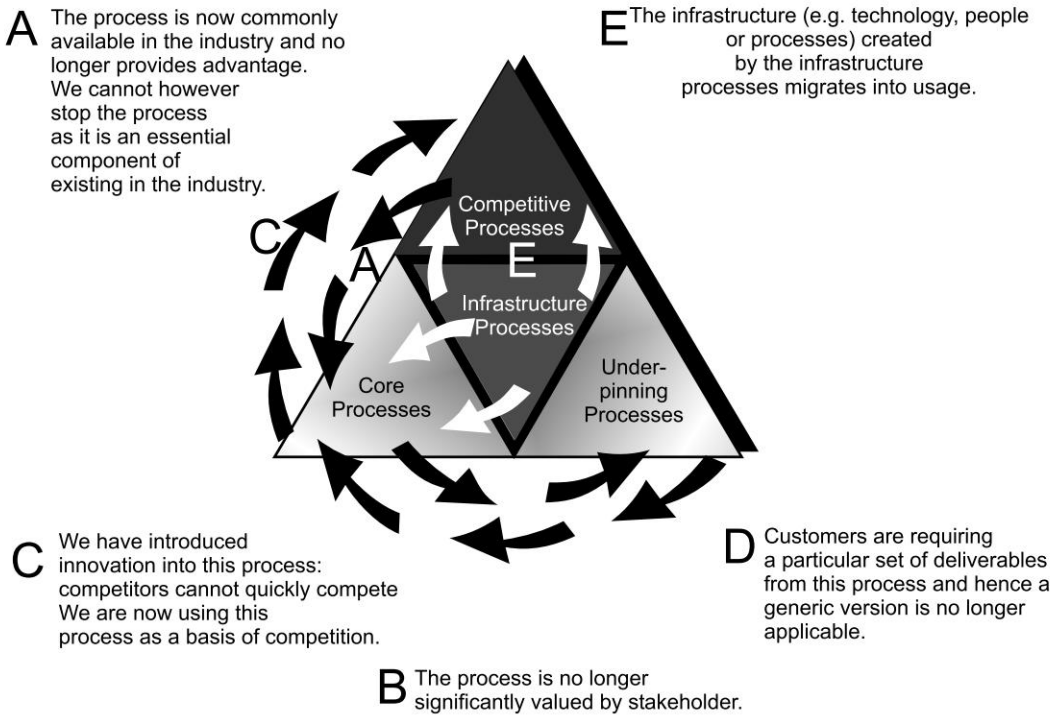


Figure 4.2 *Migrating Business Processes through Time*

4.6 A STRATEGY FOR PERFORMANCE ASSESSMENT IN BPR

A wide range of technical options are available for achieving the needed simulation modeling capabilities. One possibility is to use simulation languages, such as GPSS or Simscript, or any of a host of analytical performance assessment techniques. Use of these techniques, however, requires a great deal of skill and effort. Similar results can be achieved more easily using a simulation environment. While most commercial simulation environments do not offer all of the desired features, they provide considerable support in model specification and management. Development of a BPR toolkit based on existing simulation technology is an efficient strategy that strikes a compromise between using a general purpose simulation environment that is not entirely appropriate for BPR, and developing new tools from a scratch. For example, CACI's *Sim Process*, an easy-to-use graphical simulation environment, can be tailored to BPR modeling through custom-built add-on tools. Further examples of this approach include the SASOS system, which utilizes the simulation capabilities of Design/CPN, but uses a custom application developed in Apple Computer's HyperCard2 for its business information repository. Streng and so present an approach where interorganizational dynamics are represented in terms of Layered Actors, Networks, and Entities (LANE); the LANE representation can then be simulated (and animated) using SMC's Sirnan/Cinema.

With the growing popularity of computer aided software engineering (CASE) tool suites, it seems natural to extend CASE functionality to include performance modeling. Warren et a1. describe a prototype system that produces simulations directly from data flow diagrams as stored in a CASE tool data dictionary, and Cadre Technologies offers a performance simulator (Teamwork/Sim) as part of their CASE workbench. Warren finds that such CASE-integrated simulation leads to statistically significant improvement in design performance assessment for IS analysts.

For the moment, there is no off-the-shelf, turn-key modeling solution to achieve appropriate performance measurement in the assessment of alternative designs for BPR. The important point is not that precise simulation technology is used, rather appropriate strategy is taken. Table 4.1 summarizes the major points of the strategy, including the tools that are likely to be available to support the technical aspects of the tasks.

Table 4.1 *Modelling task and support technology in a strategy for simulation-supported BPR*

Modelling task	*Support technology*
1. Data collection and organization	Hypertext authoring tools (Toolbook, HyperCard); relational databases
2. Simulation of component designs	Simulation 4GLs (SimScript, GPSS, Sirnan/Cinema); simulation environments (SimProcess, Arena, Simview); spreadsheets
3. Integration of component simulation results	Some simulation environments (Arena, Simview); spreadsheets; custom programmes

The first step is concerned with gathering the needed data; the second step with building the models from the data and running them. The third 'integration' step is given to acknowledge that many alternative designs are likely to be considered, and that the alternatives may well differ on only a few components (although the ramifications of the alternatives are likely to be global). The management and integration of dynamic models of systems components, and their output, is likely to be a major effort worthy of project management attention. Note that the proposed strategy is for objective assessment of alternatives within a BPR effort. This strategy is to be used in conjunction with the conventional redesign steps of identifying redesign objectives, brainstorming for technological innovation opportunities and implementing the chosen design. A key benefit to identifying the modeling tasks, as shown in Table 4.1, is to make these tasks explicit targets of project management. As in all systems development activities, one should attend to the issues of what is sometimes referred to as the REDI methodology: (a) Identifying *requirements*, (b) *Evaluating* candidate solutions, (c) Conceptually *designing* a specific solution to meet the requirements, and (d) *Implementing* this solution. If we apply REDI methodology to, for instance, simulation of component designs, then:

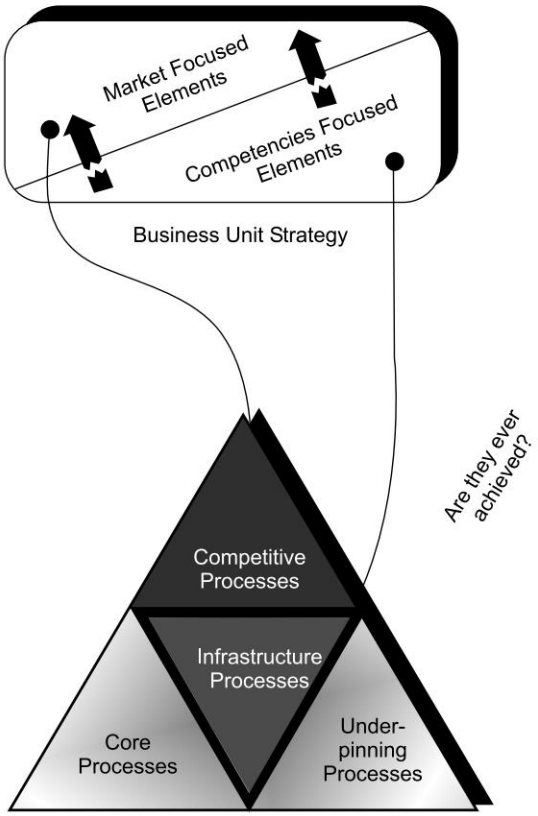


Figure 4.3 *Linking Business Unit Strategy to Business Processes*

1. **Requirements** may include ability to model resource allocation problems and sufficient ease of use for the analysis team, who have little familiarity with simulation methods.
2. **Evaluation** may consider writing simulation in a spreadsheet, using the Simscript 4GL, and CACI's SimProcess simulation environment. The third option may be chosen for its ease of use.
3. **Design** would involve working with the systems analysis results to formulate conceptual models of the performance of the business processes to be studied.
4. **Implementation** would not only entail drawing up the models in SimProcess and running them, but, prior to using SimProcess, acquisition of the tool, the hardware it needs, and training of staff to use the simulator.

The most common error in planning, over and above incorrect estimations of how long tasks would take, is to omit entirely the consideration of time- and resource-

consuming tasks. The key to successful use of simulation in BPR is accounting for all necessary tasks so that they can be managed as part of the BPR effort.

Summary

One of the critical concerns in the area of business strategy is implementation. Researchers have long talked about how strategic change has contributed to our understanding of the change process. Yet, useful frameworks are difficult to locate and operationalise.

This chapter has suggested that process reengineering can be used to identify organizational processes. The product and market focused elements of business strategy identify the processes the organization must have in place to satisfy today's customers, and hence today's competitiveness. The competency elements of business strategy dictate the processes that are needed for future competitiveness. It would be useful for organizations to analyse their competency and market elements of their business strategy and then identify the associated processes. Our experiences suggest that organizations have strategy without process, and have processes that do not implement strategy even though they purport to.

In many ways, business reengineering can be considered as business architecture planning and should be recognized as such. This architecture serves as the platform for current and future competitiveness. We believe that this view serves to bridge the gap between strategy formulation and implementation. Identification of processes that underlie the strategy gives greater direction to implementation.

However, the problem of strategy implementation is not solved, but we are one step further down the road. Forging the link between business strategy and business reengineering is the first step in strategy implementation. Migrating to new organization form, undertaking the transition and managing many other issues need to be dealt with. However, recognizing the processes that underpin strategy implementation is a vital first step.

Review Questions

1. Do you behave that in a BPR exercise, the role of strategy is of direction setting? Explain.
2. Do you think business reengineering is focused on developing an organizational architecture, linking business strategy and its organizational implementation? Justify your answer with examples.

3. How can a firm develop strategic perspectives on BPR from process configuration to organizational change?

Suggested Readings

Edwards, C., 'Forging a Link between Business Strategy and Business Reengineering', *European Management Journal*, vol. 12, pp 407–416, 1994.

Macarthur, P.J., Crosslin, R.L. and Warren, J.R., 'A Strategy for Evaluating Alternative Information Systems Designs for BPR', *International Journal of Information Management*, pp 237–251, 1994.

Tang, J., Grover, V. and Fiedler, K.D., 'Developing Strategic Perspectives on Business Process Reengineering: from process configuration to organizational change', *International Journal of Management Science*, vol. 24, pp 271–294, 1996.

5

MAJOR BUSINESS PROCESSES OF REENGINEERING

Learning Objectives

This chapter will enable the reader in understanding the role and application of BPR in the functional and applied areas of:

- Accounting
- Strategic processes
- Marketing
- Manufacturing
- Services
- Product development
- Personnel

5.1 INTRODUCTION

BPR has been popularized as one of the major techniques of change management within organizations in this era. Companies that have implemented reengineering successfully have reported that the benefits they gained included quality and productivity improvement, production cycle time reduction, more profits and improved customer satisfaction. A previous survey of 180 US companies and 100 European companies reported that three-quarters were already engaged in significant reengineering efforts. Furthermore, it was observed that companies were applying BPR owing to one of the following reasons:

- They had identified that they were in deep trouble
- They were not in trouble yet could foresee major problems ahead
- They were in peak condition but wanted more improvement

Companies that benefited from successful implementation of BPR included an American insurance and financial services company. It gained more than $50 million a year from the new process that reduced the time to process new contracts by turning a number of quotes into closed deals. A second American insurance company raised labour productivity by 20 per cent within 15 months, by redesigning claims processing. This chapter describes various areas of application of reengineering. The organization of the chapter is as follows: Section 2 presents the role of BPR in accounting. Importance of BPR in strategic process is discussed in Section 3. The role of BPR in product development, marketing, services and manufacturing sectors is discussed in the remaining sections.

5.2 ACCOUNTING

The accounting process includes product costing, make-or-buy decision, capital investment decisions, budgeting and product mix decisions. Computerized information systems, including online cost information collection and databases, help to collect information about various costs of the product at different stages of operation. The accounting system should be tailored to the production process and the company. With the development of activity based costing and management, companies are implementing more non-financial performance measures. Improvement in productivity, flexibility and innovation should be incorporated into the accounting performance measures in order to reap long term benefits. In addition, capital investment decisions should not consider only financial benefits, they should also include non-financial performance measures, such as flexibility and productivity. This area can use the online shared database and computerized information system for collecting and processing information about product price, make-or-buy decisions, capital investment and budgeting

decisions, including product mix decisions. Global financial markets and advances in IT have contributed to a revolution in the field of investment management. The Expert System for Technical Analysis (ESTA), an expert system that performs money management capabilities and helps to improve overall system performance. In addition, the possibility of supplementing ESTA using artificial intelligence (AI) and neural networks would stimulate some of the less structured expert decisions. AI models can be used to provide benefits to users, including expanded computer efficiency, increased utility, quality, flexibility and reliability.

5.2.1 Intelligent Bank Reengineering System (IBRS)

Intelligent Bank Reengineering System (IBRS) is a knowledge-based system that assists a bank in choosing the most appropriate business process reengineering (BPR) alternative. The main benefits of IBRS are to facilitate BPR efforts by helping banks to identify problems, search for alternative opportunities, and compare and evaluate 'To-Be' models generated.

Effective BPR often requires strategic use of advanced information technology. It involves in-depth analysis, exploration of alternative choices, careful evaluation of feasible solutions and appropriate planning strategies for improvements which may require construction of a new information system. Various tools exist to assist some aspects of BPR, but these tools lack comprehensive assistance for the complete BPR process. The distinctive benefits and power of IBRS come from its comprehensive support that incorporates:

- Application of formal methodology, such as IDEF modeling, workflow analysis and functional economic analysis.
- Utilization of knowledge representation techniques, i.e., rules and frames to store previous BPR cases and provide basis for analysis.
- Encapsulation of data model, process model, simulation model, economic model and search model to empower the tool to carry out effective analysis and evaluation.

IBRS manages BPR in three stages. The first is the *generation stage* that identifies BPR alternatives based on user requirements and strategic goals. The current information system, i.e., the 'As-Is' model, is represented using IDEF methodology. Constraint satisfaction search is employed to match and select candidate BPR opportunities from past experiences represented. The second is the *evaluation stage* that applies the workflow analysis and functional economic analysis to compare BPR alternatives. The third is the *choice stage* where the user selects the combination of BPR alternatives based on the generated evaluation statistics. The result of the choice stage is the best 'To-Be' model. Once the 'To-Be' model has been defined, the actual components of the new information system can be assembled using reusable codes from the code repository.

5.2.2 IBRS Architecture

IBRS consists of two major modules: IBRS Planner and IBRS Constructor. The *IBRS Planner* analyses the 'As-Is' model and recommends the 'To-Be' model, as shown in Figure 5.1. The IBRS Constructor uses the 'To-Be' model and assists in constructing a new information system by assembling reusable codes from the code repository. The model base of the IBRS Planner contains different models, such as simulation model, functional economic model, IDEF0 process model, and IDEF1X data model. IDEF models are also stored in model definition languages that allows other tools, for example, CASE tools, to utilize information. Behaviour information can be added to an IDEF0 model, which can then be used as a simulation model. Workflow analysis is performed by executing the simulation model. Functional economic analysis models provide cost/benefit analysis of the BPR alternative for upcoming periods. Functional economic analysis model generates statistics, such as net present values. The planner knowledge base is a set of rules and frames that represents knowledge required to generate and evaluate BPR alternatives, and finally choose one. Rules are used to represent heuristic knowledge and frames are used to represent knowledge of domain entities. The knowledge of BPR planner stored in the planner knowledge base covers:

- Smart card technology
- Performance history of smart card banking processes (process/performance)
- Performance history of smart card banking projects

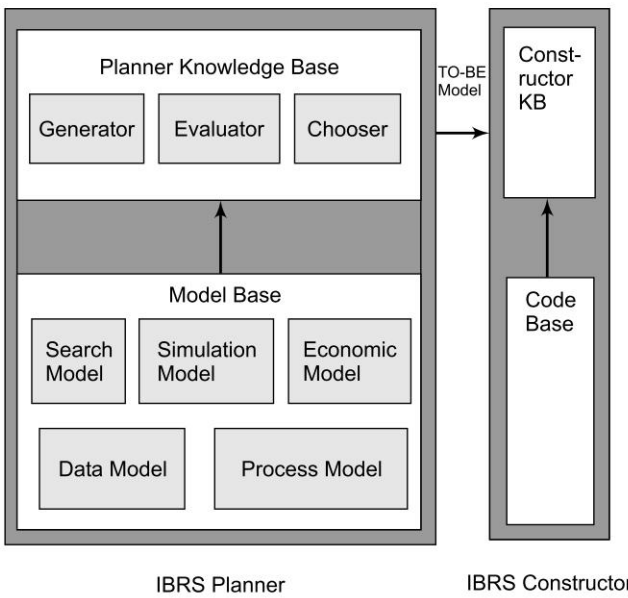


Figure 5.1 *Components of IBRS*

- BPR model management (decomposition, integration, execution)
- BPR tool and methodology

A smart card or an integrated circuit (IC) card has an IC chip on its surface and is of the same size as a credit card. Since the IC chip contains a CPU and memory, a smart card can process and store data up to 8k bytes. In addition to larger data storage, data security of smart cards is also much higher than that of magnetic stripe cards. Smart card technology provides an opportunity for banks to reengineer approval and payment processes; it allows off-line transactions and multi applications in one smart card. While Dong Sung Inforcomm (DSI) performs the smart card banking system projects for the KwangJu Bank, the DongNam Bank and the Korea First Bank, in Korea, the company has identified BPR opportunities and implemented the systems. The accumulated smart card banking knowledge of DSI is stored in the knowledge base of IBRS while IDEF0 process models are stored in the model base. The IBRS Planner solves a BPR selection problem by interacting with a user. A user specifies BPR selection criteria, and the planner assists in exploration of BPR opportunities by searching process models in the model base. The BPR selection problem is decomposed into three sub-problems: *generation*, *evaluation* and *choice problem*. IBRS' problem solving process consists of three corresponding stages similar to the knowledge based hybrid modeling approach applied to production planning of flexible manufacturing systems. The knowledge based user interface design tool incorporates the framework of generation, evaluation and choice approach to automatically generate user interface presentation, based on user specified constraints.

5.3 STRATEGIC PROCESS

The external factors influencing the supply chain, such as government policies, environmental aspects, inflation, general economic condition in the country and competing markets, should dictate the choice of strategy. Therefore, there is a need to give importance to these externalities of the network in formulating business strategies in manufacturing. All these externalities would act as constraints or present opportunities for the manufacturing system. The company should turn to a new open IT infrastructure that would link logistics, inventory and order processing operations with corporate headquarters. The formulation of strategy requires information about both internal (manufacturing capability, skills available, employee cooperation and management style) and external factors. This implies that there is a need to handle large volume of data and information processing which would help to formulate suitable business and manufacturing strategies for achieving corporate goals. IT, such as video conferencing, Netscape, Multimedia, Internet communication, database, AI and Expert systems, can be used to collect and process data. A separate module can be incorporated in the computer system to access information and exchange relevant information related to strategy formulation by people in

various functional areas of manufacturing, together with an executive information system. Obviously, the accuracy of the decision depends upon the accuracy of data collection about both internal and external factors and easy information exchange among people who are the key players in strategy formulation.

5.4 PRODUCT DEVELOPMENT

Overall, companies that have undertaken successful reengineering efforts have gained dramatic improvements in productivity and cost savings. The key is the use of powerful, low cost IT to link computer based tools. Product design and engineering and process planning can be treated as a business process. The product itself is an object that requires various aspects, such as design, engineering and process planning. These stages can be integrated using the concept QFD, CE, CAD/CAE and CAPP. The ideas of concurrent engineering need to be employed in product development with an objective to reduce the lead time for design and production by eliminating non-value added activities at different stages of the product life cycle. Advances in automation and IT during the last decade have been especially striking in programmable controller based supervisory control, execution systems and computer aided design. These technologies share a dependence on even more basic engineering advances in microprocessors and personal computers. A framework for product development is mentioned in Figure 5.2.

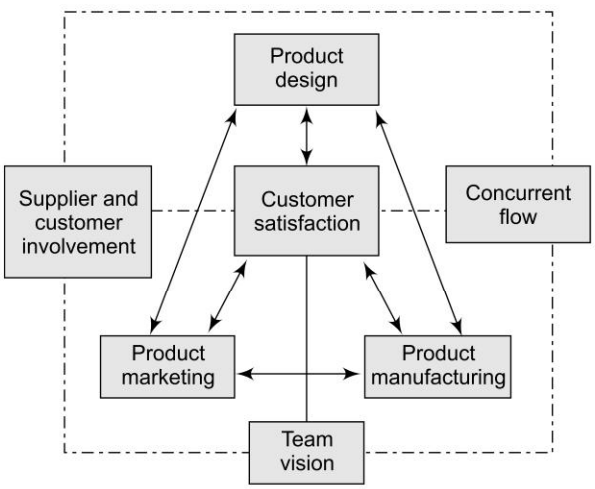


Figure 5.2 *A framework for Product Development*

5.5 MARKETING/SALES

Marketing and sales are two of the most information intensive functions in business. Marketing research, in particular, is prime benefactor of IT innovations.

Even now, CD-ROM libraries are being introduced that carry the full image of articles. Primary data collection is being transformed by IT. Computer assisted telephone interviewing (CATI) has become more prevalent. Changes, now under way, include a programme to provide the sales force with modem-equipped laptop computers to transmit customer orders right to the order-entry department. The information does not have to be rekeyed after it is received from a salesperson. Instead, it is simply downloaded for use by the product-flow teams that run the simplified, streamlined and reconfigured manufacturing lines. Examples of EDI application include the issue of purchase orders, receiving invoices and payment from suppliers. Marketing/sales as a process requires to integrate activities, such as market research, forecasting and feedback, with the objective of providing necessary information to the management in order to satisfy the customers with required quality products and services. This could be achieved by a smooth flow of information between customers and the marketing department, and then to the manufacturing department. Information communication, such as Multimedia and Internet systems, can be used to exchange and collect information from customers and within the company as a whole.

5.6 SERVICES

It is an important element of value adding areas in any organization that has distribution as its business process. A growing number of companies are deciding to contract out the transportation function, thereby cutting costs and improving customer service. Specific aspects involving strategic relationships between companies and carriers need to be analysed. While these specific aspects are yielding significant cost savings, they are part of a much broader reengineering trend that involves every stage of the supply chain and requires companies to redefine the process by which products are made available, delivered and paid for. Aspects that are to be considered in strategic alliance with distribution carriers include improving the utilization of equipment, and elimination unnecessary paper work (through long term relationships, computer control information system). Information automation systems are available for distribution and logistics operations, which often grow cumbersome and ineffective at the expense of cost and customer service. They include logistics dependent companies from process and discrete manufacturing, retail, apparel distribution and public warehousing. Client/server technologies can be used to share information company-wide, and managers can see the total system instead of individual functions, such as marketing or distribution. Client/server is a computational architecture that involves client processes requesting service from server processes. The main advantage of an open client/server system is the flexibility about the hardware and the software used. A typical client/server technology has three levels architecture: *presentation layer*, *business logic* and *data layer*.

The effectiveness of client/server open systems enables downsizing and information automation in all aspects of a company's operation.

5.7 PERSONNEL

When the process of manufacturing is being reengineered, what is really happening is the revamping of the way people think and interact with one another. Experts in BPR have described the advantages of application of human performance engineering to problems of employee, manager and organizational development. They have introduced a new method, called *Human Performance Engineering* (HPE), for organizing, developing and challenging the human resources of an organization, utilizing geometric or algebraic principles as typically found in engineering analysis together with functional elements of performance. A mechanical and economic visualization of the relationship within a particular organization, reflecting human resources change and the corresponding result, the problems related to human resources from top management to the production floor, and a new way of defining jobs, establishing accountabilities, training, and organizational development using the practical concepts of HPE would help to improve the human factors in BPR. Employees expect their organizations to take a more active role in addressing the stress they face in managing their work life with their home life, especially in BPR. Six recommendations were made: provide greater work time flexibility, provide greater work location flexibility, take an educational role, make a commitment to promote women, re-examine benefit packages and educate managers. Technologies, such as Multimedia, CAD/CAM and Internet can be utilized to improve the cooperation of employees with business and manufacturing strategies and to reduce the stress of workers in performing various operations in BPR, by open and more reliable communication systems.

5.8 MANUFACTURING OPERATIONS

Defining the process to reflect a drastic change in manufacturing operations would be very difficult to generalize as they need to be tailored to the organizational and production characteristics. For example, some companies may have product development as a part of business strategy. In that case, the major process for the company would be the new product development. However, new product development, in that case, should take into account the principles of design for engineering, design for manufacturing, design for distribution and handling, etc. Depending upon the organizational characteristics, vertical, horizontal or hybrid, and the information flow the corresponding information system should be designed. Two companies may have the same business situation. However, each company should reengineer its business process based on the process and

not the function, and it should be tailored to the characteristics (organizational structure, skills available, capital available, products, production facilities, etc.) of the company under consideration. Suppose an automobile manufacturing company has received an order from a customer for a specific automobile. If the company's objective is to quickly meet customer demand, then the company needs to analyse the flow of information and materials along the supply chain. The simplification and standardization of the flow of materials and hence the flow of information may facilitate reengineering to improve the overall system performance. The congestion at every point in the supply chain should be identified before formulating information strategy. Information systems such as CAD/CAE/CAM, EDI, EFT and Multimedia, can be used to reduce the lead time of order flows. Treating the delivery process as a project requires the removal of barriers with information and material flows through the use of advanced IT, such as multimedia and shared databases, and the process team should consist of people from different functional areas, AI and Expert Systems and CIM. These technologies can improve the computer supported cooperative work in the factory, and thus the effectiveness of the system. The process flow chart of the role of reengineering in manufacturing operations is shown in Figure 5.3.

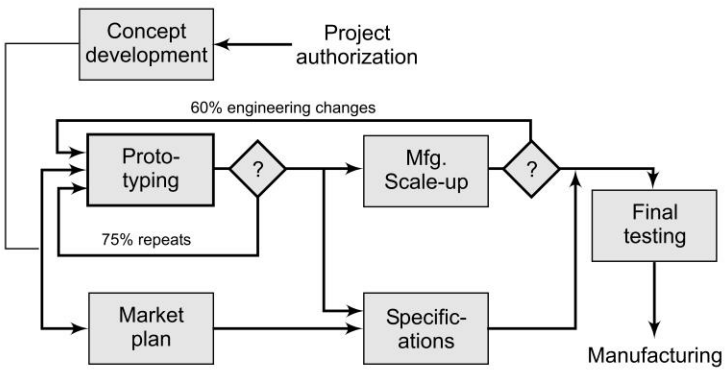


Figure 5.3 *Operations Management and Reengineering*

Summary

A wide variety of business processes may be changed as a result of the BPR efforts in a variety of business processes. Furthermore, a high proportion of the companies recognize the important role that IT plays in BPR projects, particularly in the areas of data management and factory management systems. The main conclusion of this research is that adopting robust strategic planning and process management techniques to achieve maximum benefits of BPR

for the long term rather than short term can overcome the difficulties associated with it. All elements, such as organizational structure, empowerment, training, IT systems, etc., should be considered together, as it is not possible to modify just one element without considering its influence on the others. Also, in order to improve business processes successfully through IT enablers, effective communication, coordination and understanding are required. Thus, before applying BPR to redesign processes, managers should lead a strategy to improve organizational performance by:

- Prioritising business processes for BPR application based on strategic goals
- Establishing appropriate company-wide targets and measures for BPR
- Emphasizing continuous improvement for the long term rather than short term
- Developing better communication channels based on self assessment
- Understanding the needs of employees rather than focusing on downsizing
- Developing appropriate reward systems for encouraging people involvement
- Improved coordination of people and appropriate technologies

Review Questions

1. Select an organization of your choice for any one of the given business processes and develop a reengineering plan to improve its performance:
   (a) Accounting
   (b) Strategic process
   (c) Product development
   (d) Marketing
   (e) Services
   (f) Personnel
2. Chart out the different phases for executing BPR plan for any one of the business processes mentioned in Question 1.

Suggested Readings

Davenport, T.H., 'Will Participative Makeovers of Business Processes Succeed where Reengineering Failed?', *Planning Rev.*, 23(l), pp 24–29, 1995.

Gunasekaran, A. and Nath, B., 'The Role of Information Technology in Business Process Reengineering', *Int. J. Production Economics*, vol. 50, pp 91–104, 1997.

Hammer, M., 'Reengineering Work: Don't Automate Obliterate', *Harv. Bus. Rev.* 68(4), pp 104–l12, 1999.

Hammer, M. and Champy, J., 'Reengineering the Corporation: A Manifesto for Business Revolution,' *Harper Business*, New York, 1993.

Loch, C., 'Operations Management and Reengineering', *European Management Journal*, vol. 16, pp 306–317, 1998.

Mina, D.M., Kim, J.R., Kim, W.C., and Min, D. and Ku, S., 'IBRS: Intelligent Bank Reengineering System', *Decision Support Systems*, vol. 18, pp 97–105, 1996.

Owen, D., Hubbard, B. and Blair, G., 'IE Techniques Improve Productivity at Service Companies', *Ind. Eng.*, 25(12), pp 27–30, 1993.

Pens, N., 'Total Quality Management', K.U. Leuven Centre for Industrial Management, Leuven, 1995.

Zang, Q. and Cao, M., 'Business Process Reengineering for Flexibility and Innovation in Manufacturing', *Industrial Management and Data Systems*, vol. 102, pp 146–152, 2002.

6

IT, SOFTWARE REENGINEERING AND ERP IN BPR

Learning Objectives

This chapter will help the reader in

- Discussing the role of IT in BPR
- Understanding the need of IT infrastructure for BPR
- Explaining the association of BPR and ERP
- Discussing ERP and supply chain performance
- Discussing software reengineering concepts
- Understanding software reengineering phases and tasks

6.1 INTRODUCTION

Today's business environment is more techno-centric and intensively competitive. This has resulted in fast-changing business models dominating the market. One such change is the implementation of IT in BPR. IT can help in cost reduction, product differentiation, quality improvement, integration with customers and suppliers, organizational learning and creating new business opportunities.

6.2 INFORMATION TECHNOLOGY

Information Technology (IT) typically refers to equipment (computers, data storage devices, network and communication devices), application (software), services (end user computing), helpdesk and application development, which are used by organizations to deliver commodity, information and knowledge of inputs and processes. The rapid growth in IT with respect to capacity, quality and cost reduction offer tremendous potential to BPR efforts in providing strategic value to an organization. It can be used for cost reduction, product differentiation, quality improvement, integration with customers and suppliers, organizational learning and creating new business opportunities. Table 6.1 gives IT capabilities and their organizational impacts.

Table 6.1 *IT Capabilities and their Organizational Impacts*

	Capability	*Organizational Impact/Benefit*
1	Transactional	Convert unstructured processes into routinized transactions
2	Geographical	Transfer information with rapidity and ease across large distances, thus making the process independent of geographical distances
3	Automational	Replace or reduce human labour in a process
4	Analytical	Bring complex analytical methods to impact a process
5	Informational	Bring large amounts of information into a process
6	Sequential	Enable changes in the sequence of tasks in a process, often allowing multiple tasks to be worked on simultaneously
7	Knowledge	Allow capture and dissemination of knowledge management and expertise to improve a process
8	Tracking	Allows detailed tracking of task status, inputs and outputs
9	Disintermediation	Can be used to connect two parties with a process who would otherwise communicate through an intermediary

Source: "The New Industrial Engineering Information Technology and Business Process Redesign", *Sloan Management Review*, May 1, 1993.

6.2.1 Role of Information Technology in BPR

Information technology can play the role of an enabler and an implementer in BPR efforts. It is to be understood that IT is one of the several enablers in BPR process.

Hence, there is need to analyse its relevance to the BPR process and make a cost vs. benefit analysis. IT can influence process redesigning instead of just complimenting or supporting it. The capabilities listed in Table 6.1 are positively impacted by improving technology. It can provide the opportunity to utilize newer and better technology to improve business processes. For this, it is required to have a knowledge of IT's present and future capabilities and ways to incorporate them in the redesigning process.

As an implementer in the BPR process, IT can play a facilitation role with respect to several key activities, like:

- Identifying and selecting processes for redesign
- Identifying enablers for process design
- Defining business strategy and process vision
- Understanding structure and flow of current process
- Measuring performance of current process
- Designing and prototyping the new process
- Implementing and operationalising new processes and associated systems
- Communicating ongoing results of the BPR effort
- Building commitment to BPR

All these activities can help increase the quality of information available for designing by utilising informational and analytical capabilities of IT.

IT can also be used to identify other enablers of BPR. It can be expert systems and technological databases which provide information on current and future capabilities of technology, human resources, organizational change, etc. IT can also help in sharing and retrieving unstructured multimedia information that can be useful for developing process prototypes. IT implementation can be facilitated through the use of project management tools, Systems Development Life Cycle (SDLC) methodology products and rapid application development tools. IT can help overcome geographic barriers and thus enable broader acceptance of the process change. Project management and analysis tools can facilitate in tracking and managing cost commitments.

6.2.2 BPR and IT Infrastructure

IT infrastructure in an organization acts as a platform to enable quick development of process specific applications. It includes standardized architecture, extensive communication capabilities and shared database access. This helps in coordination of overall BPR efforts and supports continuous process change. Implementation of such an infrastructure can be a challenging task, given the heterogeneous software, hardware and other infrastructure typically present in a firm. The challenges in linking multiple custom infrastructures may include:

- Providing transparent access to information

- Ensuring consistent, high performance service delivery
- Linking geographically diverse systems
- Ensuring information technology strategy is consistent with business goals
- Implementing efficient change management
- Providing and tracking cost containment
- Providing enterprise wide security

The solution lies in removing the barriers of localized technology and transforming them into a uniform open distributed infrastructure.

BPR can be successful in an organization when business and IT managers realize the benefits of viewing BPR and IT as mutually supportive and synergistic. By leveraging the capabilities of IT during BPR, an organization can achieve full potential of its skilled employees.

6.3 ENTERPRISE RESOURCE PLANNING

According to experts on BPR, 'reduction in cycle time in organizational processes is directly associated with improved performance, quality, and customer satisfaction.' Furthermore, a commitment to a long term organizational learning orientation is strongly related to efficiencies and customer service levels achieved via cycle time reduction. No doubt, cycle time compression by automation of marketing processes is considered a critical dynamic for gaining strategic advantage in today's industrial markets. In order to obtain desired customer service levels, information technology (IT) has frequently been used as a valuable tool to assist management in improving supply chain performance. At the forefront of business automation and technology, *enterprise resource planning* (ERP) enables corporations to pursue highest level of customer relationship, management, and is therefore considered essential by forward thinking marketing executives. An ERP system creates an enterprise wide transaction structure by integrating key functions, like manufacturing, finance, marketing, human resource management and logistics, within a common information system platform. While ERP systems can be used in many functional applications, the importance of lead time and order cycle time reductions have shown that they are critical for optimizing marketing operations and overall supply chain performance.

The use of ERP is closely associated with *business engineering* (BE), the optimization of business processes. In the context of Fortune 1000 corporations, SAP is widely recognized as a market leader in comprehensive, multifunctional ERP systems based on longitudinal BE benchmarking. The marketing processes modelled in SAP are based on 25 years of benchmarking on successful and unsuccessful companies. Many companies implement SAP software to improve their business processes, cycle time being a major performance measure. Specifically, the SAP sales and distribution (SD) module addresses multiple cycle time issues, including customer service levels,

cost control and inter functional coordination. In other words, marketing processes have been designed and streamlined based on extensive longitudinal analysis across industries. Obviously, as indicated earlier, a strong organizational learning orientation is crucial for industrial marketing managers to 'rethink' their operations in this 'brave new world.' In this chapter, we will provide illustrative insight on how an ERP system can be used as a tool to help improve the performance level of a supply chain network by helping to reduce cycle times. Given how much is at stake for industrial marketing management, this prescriptive overview will feature several areas of critical concern in real business examples.

6.3.1 ERP and Enhancing Supply Chain Performance

Technology has accelerated the delivery process in several ways, including automation of various integrated information management approaches, like adoption of an ERP system. Effective implementation of an ERP system is designed to allow different functions or entities to share valuable information and collaborate in strategic planning sessions. In the context of marketing operations, effective collaboration with other internal corporate functions and external supply chain partners has resulted in decrease in order variation, curtailment of order size fluctuations, and reduction in inventory levels. For example, Heineken USA implemented collaboration throughout their supply chain and cut their delivery time by half. Prior to implementation, the average time from order to delivery was 8 weeks. However, subsequent to collaboration, the time from order to delivery was reduced to an average of 4 weeks. Improved cycle times are one way to help achieve the level of service desired by today's customers. Better cycle times have been shown to lead to quicker order fulfillment, improved demand forecasting, and enhanced inventory management. As a result of compressing the flow-through time of the entire supply chain, reduced cycle times can positively impact the marketing strategy of the company by creating a differential advantage in the marketplace. Using an ERP system to integrate the marketing and logistics functions together allows for improved coordination and information sharing between the two functions, helping to create a seamless delivery process to the customer. The seamless delivery process coupled with the economic efficiencies and differential advantages gained by reduced cycle times can lead to a sustainable competitive advantage in the marketplace if implemented correctly.

6.3.2 Cross Functional Integration vs. Hierarchical Functional Orientation

Enterprise systems have replaced information systems built to support individual functions or departments. The old legacy systems often consisted of custom software pieced together on mainframes. With their own isolated databases, these systems effectively kept information from flowing easily to other functions. Information would travel up the organizational hierarchy in aggregate form. Other functions generally

had to reenter the original data, with the added risk of data inaccuracy, interpret the aggregate data, or develop a custom link to the other system. This functional orientation inhibited the flow of information and contributed to the degradation of cycle times. BE focuses on restructuring the flow of work, information and materials to reduce marketing cycle time, lower costs and improve quality. On implementing ERP, business processes become business engineered. Enterprise systems are designed to support integrated, cross functional processes. The company adapts its processes to those modeled by the software. Indeed, one of the primary reasons to adopt ERP is to achieve the benefits of BE. The following case excerpts illustrate how a variety of marketing processes can be improved by implementing ERP.

6.3.3 Data Sharing

A primary advantage of ERP systems is that they are integrated using a common database. They are designed for sharing of data in organizations with many employees using the system concurrently. Once a transaction is entered, the data are available for reference and use by other functional areas within the company as well as external entities serving as supply chain partners. For marketing managers, this means:

- Information on an order is immediately carried into shipping without reentry or interfacing
- The customer master record used for entering the order is the same as billing and cash processing
- The result of shipping would automatically update inventory quantity and the general ledger, allowing supply chain partners to efficiently implement cost saving practices, like vendor managed inventory

Shared data expedite the processing of business transactions for a more rapid response to customer requests. Micrografx, a developer and marketer of graphics software, found that R/3's integrated SD applications produced significant dividends. Micrografx has significantly reduced the time taken to process orders. With R/3, routine tasks are automated and orders are entered only once. Prior to R/3 implementation, it was necessary to enter, print, and fax orders to other Micrografx organizations where the information was reentered into a separate system. Other benefits include the maintenance of a single customer database and a sales tax interface that automatically calculates sales taxes on all orders and invoices.

6.4 SOFTWARE REENGINEERING AND ITS OBJECTIVES

Reengineering in software refers to reworking on the existing software, that has become obsolete, with current technology. It is difficult to understand the existing software system without the availability of code and documents. The examination, analysis and alteration of a system, and its implementation in new form, constitute

reengineering. The existing functionality is maintained and preparations are made for enhancing functionality later.

The general objectives are:

- Migration to new software
- Functional enhancement preparation
- Maintainability improvement
- Reliability improvement

As the computer industry grows, and software and hardware components become obsolete, it becomes necessary for organizations to migrate to new platforms or operating systems. In functional enhancement preparation, the characteristics of the existing system are compared to the characteristics of the desired system, and the reengineered target system is built to easily facilitate the enhancements. Increase in maintainability costs, owing to changes over time, is controlled by redesigning the system with appropriate modules. Thus, maintainability improvement is achieved. Fourth objective is the natural outcome of the first three objectives since reliability of the software decreases as maintenances and changes increase.

6.4.1 Concepts of Reengineering

Figure 6.1 shows the levels of abstraction which correspond to the different phases in the development life cycle of the reengineering process. We have considered reengineering and the factors associated with it in Chapter 1.

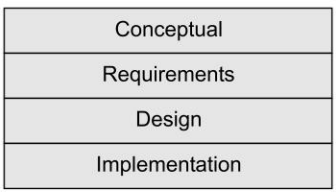


Figure 6.1 *Levels of Abstraction*

At the conceptual abstraction level, the system concept is described. Functional characteristics of the system are described in detailed terms in the requirements abstraction level. The design characteristics are described in the design abstraction level, the last level focuses the implementation characteristics.

6.4.2 Phases and Tasks in Reengineering

The reengineering process consists, of 5 phases, as given below:

1. **Formation of a team** to manage the reengineering effort from beginning to end. The team needs a comprehensive training in this aspect.

2. **Feasibility analysis** consists of evaluating the organizational needs and goals that the existing system meets and ensuring that the reengineering strategy fits the organisation's cultural norms.
3. **Analysis and planning** consists of analysing the legacy system, specifying the characteristics of the target system, and creation of a standard test bed or validation suite.
4. **Implementation** consists of unravelling the actual functions of the legacy system by reverse engineering, and normal software development by forward engineering.
5. **Transition and testing** consist of doing tests to detect errors. Documentation on legacy is updated and rewritten on this phase.

Reengineering is not free from risks. Risk identification is essential for risk assessment, risk analysis and management.

6.4.3 Conclusion

As the software industry advances, many new software design methodologies are developed, improving software reusability and maintainability and decreasing development and maintenance time. But most companies have legacy systems that are out of date and costly to maintain. These systems cannot just be replaced with new systems. They contain corporate information and implied decisions that would be lost. They are also an investment, and are too costly to develop and evolve to be discarded. For these purposes, reengineering becomes a useful tool to convert old, obsolete systems to more efficient, streamlined systems. We have discussed in detail the reengineering concepts, the reengineering phases and tasks.

Summary

In this chapter, we have looked at the definition of IT, its capabilities and organizational impacts. We have discussed the role of IT in BPR and the type of IT infrastructure that should be developed for a successful BPR. The role of IT is basically an enabler of BPR and presents both opportunities and constraints as an implementer of BPR. IT can facilitate activities ranging from processes, designing and prototyping a process, to finally implementing it. It can help identify enablers, define business strategy along with them and communicate ongoing results.

We have also looked into the concept of ERP and industrial marketing. Marketing cycle time reduction through the implementation of ERP systems is clearly a 'real-time' process

for not only marketing management but also for the customers. This is reflected in the supply chain management philosophy where customers are strategic partners in the joint quest for continuous improvement of business performance throughout the supply chain. Therefore, in concert with this notion, customers should not be 'surprised' at any stage of ERP implementation by marketing firm. In fact, customers' concerns are industrial marketers' concerns in the process of ERP system implementation, and both stand to gain a great deal from marketing cycle time reduction.

Review Questions

1. Define IT. Discuss how IT capabilities impact an organization.
2. What is the role of IT in BPR? Identify the key activities where IT can play a facilitation role.
3. How should a firm build its IT infrastructure for a successful BPR?
4. Is ERP an essential enabler to BPR?
5. How does ERP contribute in supply chain performance?
6. Explain with an example how data sharing is related to BPR.
7. Explain in detail the various reengineering concepts.
8. Explain software reengineering phases and tasks in detail.

Suggested Readings

Gardiner, S.C., Hanna, JB and Latour, M.S., 'ERP and the Reengineering of Industrial Marketing Processes: A Perspective Overview for the New-age Marketing Manager', *Industrial Marketing Management*, vol. 31, pp 357–365, 2002.

Radhakrishnan R., and S. Balasubramanian, *Business Process Reengineering: Text and Cases*, Prentice-Hall of India, Ch. 12, 2008.

7

POSSIBLE MODELS OF REENGINEERING

Learning Objectives

This chapter will enable the reader in understanding

- ARTEMIS Model of BPR
- SHAMASH: A knowledge based model
- Practical model on BPR
- Innovation model for business reengineering
- Integrated enterprise model

7.1 INTRODUCTION

Business process reengineering days an important role in most private and public sector organizations to improve existing information systems and software applications. In fact, owing to evolution of organizational requirements and availability of advanced information technology, more and more organizations are today promoting activities for restructuring and innovating their information systems for enhancement of service and product quality and customer satisfaction.

According to the reengineering paradigm, the primary focus is on 'process engineering' activities that require a deep understanding of organization processes and related data, to obtain a comprehensive vision of the system. Then, evaluation of possible restructuring interventions is done. As a consequence, any project of business process analysis and reengineering starts by creating a possibly formal representation of the process itself. In theory, techniques and tools for process modeling and analysis are studied, and, for the analysis of legacy applications and databases, reverse engineering techniques are suggested to derive their conceptual descriptions.

This chapter discusses almost all possible business models on BPR, one by one. The main goal of process modeling is to represent the considered processes in a clear and formal way at different levels of abstraction. Availability of sound models allows a critical analysis of the existing activities to define improvements and rationalizations of the processes to form the basis of redesign interventions. Several models have been proposed, that can be used according to the objectives to be pursued. Some were developed expressly to describe business processes, while others were initially developed to describe other processes (For example, software processes) and were extended to capture business processes peculiarities. When reengineering is performed in complex organizations, additional requirements arise. In fact, complex organizations are characterized by the presence of a high number of subordinate level organization units, which are distributed and have their autonomous information systems, with specific application contexts and support technologies. This chapter mainly discusses the sensitive issues like (i) business processes to be reengineered, which are inherently distributed across multiple organization units and analysis required to handle heterogeneous terminology in the description of their constituent activities and (ii) restructuring interventions to enhance the quality of services and products to improve information sharing and optimization.

In the subsequent sections, we discuss the various models of reengineering.

7.2 ARTEMIS MODEL

This section presents the methodological approach to business process reengineering underlying the ARTEMIS tool environment. The general architecture of the

methodology is shown in Fig. 7.1. Basic elements of the ARTEMIS methodology are similar to the conventional engineering methodologies. Distinctive reengineering phases are related to process analysis and redesign, concerned with evaluation and optimization according to the user defined criteria. In particular, these phases are conceived to take into account requirements posed by distribution and heterogeneity aspects of business processes in complex organizations.

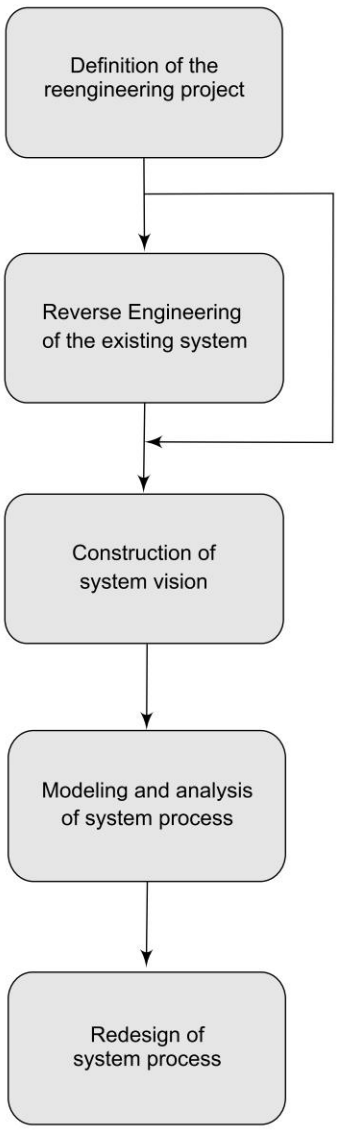


Figure 7.1 *ARTEMIS Model of BPR*

7.2.1 Phases of the Methodology

Phase 1 This phase starts the reengineering project. It is constituted by the following steps:

1. Definition of a team, responsible for business process reengineering project
2. Planning of project development and identification of the needed resources
3. Definition (adoption) of methods and tools to be used in the project
4. Establishment of the operational environment

Phase 2 This phase is reverse engineering of the existing system. This phase is optional, depending on the existence of legacy systems and corresponding useful documentation. Reverse engineering techniques are used to facilitate the understanding of existing legacy systems, by recognizing main system components and the links between them at a conceptual level. Two main techniques are considered.

1. **Redocumentation:** This technique allows the generation of schematic and summarized documentation in terms of diagrams (For example, entity relationship diagrams, data flow diagrams and simplified programme descriptions).
2. **Design Recovery:** This technique allows the generation of conceptual design descriptions, starting from programmes, design documentation (when available) and problem and application domain knowledge. It is important to produce as much information as possible to understand the *what*, *why* and *how* of system functions.

Phase 3 In order to succeed, the reengineering project must be founded on the strategic vision of the organizational system. This phase constructs the system vision. This is done in following steps:

- *Process requirements collection*: Interviews and questionnaires are used to identify processes to be analysed for reengineering. For a first qualitative assessment of the goals, possible market investigations are conducted to evaluate customer needs and requests. Furthermore, benchmarking activities and comparison with other competitive organizations help in specific process reengineering interventions.
- *Business objective definition and choice of the processes*: This is done through strict collaboration with personnel of the organization, according to defined criteria (For example, Porter's value chain, standard or ad hoc checklist). Business objectives are identified on the basis of deficiencies and problems actually

affecting the processes. Typical examples of reengineering objectives are related to the improvement in quality of services and/or products, improvement in information use and sharing, and customer satisfaction. Based on identified objectives, business processes are selected for analysis.

Phase 4 This phase deals with modeling and analysis of system processes. To obtain a formal description of their properties. The steps involved are:

- *Process work flow modeling:* It is devoted to construction of comprehensive description of different process aspects (i.e., technological, human, macro-organizational) at different levels of abstraction. In ARTEMIS, business processes are modeled using a work flow model.
- *Process work flow analysis:* It is devoted to deep analysis of activity execution and coordination, of the exchanged information, and of the employed organizational resources. In particular, parameters significant to business objectives are evaluated, such as service quality, productivity and efficiency. Specific restructuring interventions to redesign processes in order to meet business objectives are identified.

Phase 5 This phase redesigns the system processes based on the results of the modeling and analysis phase**.** The redesign activity may require restructuring of processes, together with redefinition or reexamination of the organizational structure, and of information flows. Steps in this phase are:

- *Prototype implementation of restructured processes, with consequent adequacy testing and impact evaluation* (For example, by means of simulation tools).
- *Implementation of new processes and results monitoring*, by planning an initial pilot test environment to be incrementally extended to the whole organization. In this step, training and monitoring activities have to be scheduled to cover organizational, technological and human factors. The objective is to obtain global integration of the new processes in the organization.

7.3 SHAMASH: A KNOWLEDGE-BASED MODEL

Current organizations need continuous and dynamic reorganization of their processes to become more efficient. The principal aim of business process reengineering (BPR) is to design techniques to allow simulation and check different sets of processes for improving the organization. This task may be accomplished manually or by using modeling tools. Currently, there are many sophisticated modeling tools that help organizations in making their processes more efficient by allowing graphical designing of process models and simulating them. Though these tools are very sophisticated, current technology may further be used to

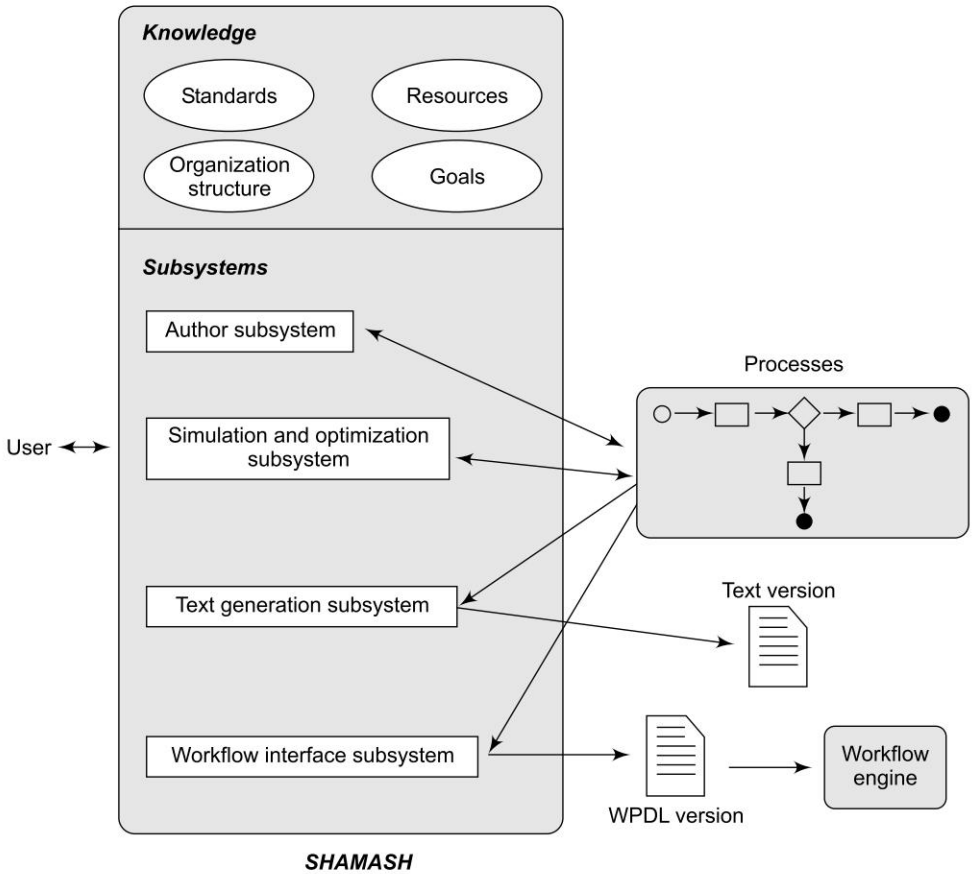


Figure 7.2 *SHAMASH Model of BPR*

automatically optimise and simulate the processes and allow explicit representation of the standards that constrain processes.

SHAMASH shares some of its capabilities with other BPR tools, like offering an interface for process modeling, simulating these processes, and exporting processes to workflow process description language (WPDL). In addition, SHAMASH is able to automatically improve an existing model by using all optimization techniques. It also permits defining of organizations and process standards, are used that to automatically validate user process models. Another remarkable characteristic of SHAMASH is that it offers a powerful language to describe rules for the system, and also a specially built inference engine to manage them. Most of the knowledge required in the system can be represented by means of such rules. For instance, the knowledge required for optimizing, describing the behaviour of activities during

simulation, and defining the standards, can be defined by using rules. This makes SHAMASH an extensible and customizable tool.

The general architecture of SHAMASH tool is given in Fig. 7.2. It is composed of four subsystems, which are discussed below.

7.3.1 Author Subsystem

Through a user friendly interface the user can define two types of knowledge to the system: knowledge on standards, and knowledge on processes. *Standards*, or *norms*, are statements on any organization that define how processes should behave, be created, achieve business rules, or maximize organization goals. In most cases, this type of knowledge can be easily translated into rules formalism, so SHAMASH allows the user to interactively create these rules in a language that is easy to understand. We believe that current information technology users are no longer unaware of technology, and the concept of a rule is very close to humans. They are able to generate an output from an input, using organization resources. In context of SHAMASH, processes are not constrained to business processes. Therefore, the tool has to be general enough to allow defining of all types of behaviour to represent all types of processes, from chemical plant processes to marketing ones.

7.3.2 Simulation and Modelling Subsystem

The tool allows performing simulations with historical or predicted data. Results are analysed by the system, and misbehaviours are reported to the user. Also, the tool can automatically perform an optimization phase by which new optimized models are generated. The user can then decide whether to adopt the new models, or to continue with the old ones.

7.3.3 Text Generation Subsystem

In most organizations, processes are delivered to their end-users (human resources of the organization) in plain text. Sometimes, they are delivered using a graphical representation, without the details that, for obvious space restrictions, cannot appear in the graphical representation. And, in some organizations, processes are delivered in a mixture of graphical and text representations. A common consistency problem appears when any one of the representations or both are updated. In those cases, the previous one has to be changed, and this does not always happen. In SHAMASH, this subsystem is responsible for maintaining coherence between the graphical and text versions. When the user performs any change in the graphical representation of a process, this subsystem automatically generates a new text version of the process.

7.3.4 Workflow Interface Subsystem

SHAMASH is not to be used directly as a workflow engine. Therefore, it needs to have an interface that automatically translates the defined process models into the input of a workflow engine. As for the output language, the goal would be to generate a process representation complying with the intended standard workflow management coalition (WFMC) workflow process description language (WPDL). However, given that there is still no general consensus on the language, has been adopted a practical approach by generating the output in the current version of WPDL.

Also, the tool allows the user to create and maintain knowledge about the organization that would be used when defining, simulating, and optimizing the processes. Types of knowledge that can be defined within the system are knowledge about standards, processes, organization structures, resources (human and material), or goals of the processes. The general architecture of this module is shown in Fig. 7.2.

7.4 PRACTICAL MODEL OF BPR

Several models or steps have been proposed in the text for undertaking BPR. However, as yet, no standard integrated methodology for BPR exists. With the increase in the number of organizations launching reengineering efforts, there is need for a more practical framework to guide leaders through the process of innovation and change. Figure 7.3 depicts a six phase comprehensive reengineering plan that organizations should consider when implementing BPR. The inputs for this model were generated from the review of literature. The six phases of the model include *understanding*, *initiating*, *planning*, *programming*, *transforming*, *implementing*, and *evaluating*. In the *first phase,* the top management recognizes the need for change, and develops a complete understanding of what BPR is, and how they plan to achieve it.

Once the understanding and commitment is made, a vision is created in the *second phase*. Based on the clear vision, the management selects business process(es) that need to be redesigned, defines clear and measurable objectives for redesigning the reinvented process(es), and forms project teams for these reengineering efforts. The literature suggests executives and key staff members from the primary organizational units involved in the process(es) and the information systems department should be included in the team(s). In the *third phase*, the project team evaluates and documents current processes, uncovers bottlenecks, and establishes baselines and benchmarks for gauging future improvements. During this phase, the efforts of the project team are focused on identifying breakthrough opportunities and designing new work steps or processes that would create quantum gains and competitive advantage.

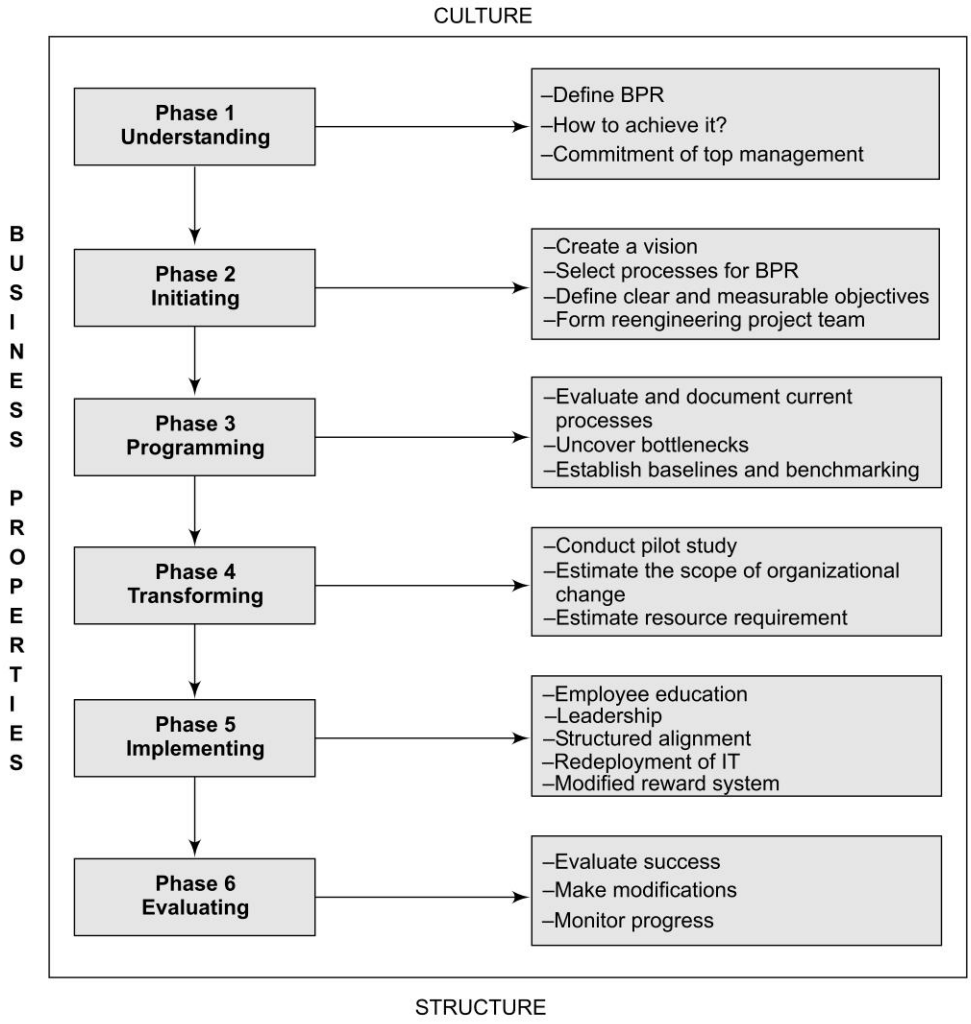


Figure 7.3 *Practical Model on BPR*

The *fourth phase*, referred to as 'transforming', involves actual transformation to the reinvented process or organization. This transformation should take place in a small scale pilot environment. Conducting a pilot study helps in:

- Fine tuning of the new process design
- Enhancing management's and employees' understanding of the new process(es)
- Providing realistic estimates of the scope of organizational change and resource requirement.

After the pilot study is successfully undertaken, the new reengineered process(es) is/are fully implemented and successfully integrated into the organization. This constitutes *phase five*. Successful integration involves:

- Employee education
- Leadership
- Structural alignment and redeployment of technical and human resources
- Modified reward system

Changes made during this change may cause resistance or resentment that need to be addressed through continual communication among management, the project team, and the employees.

The *final phase (phase 6)* of the model involves evaluating the success of the reengineering efforts against the performance objectives established in phase two. For example, if the reengineering efforts have not achieved all goals, they should be redesigned and modified accordingly. This phase is important as it is one of continuous commitment to the process of reengineering. In addition to these phases, business leaders should also keep in mind the following:

- Beware of the reengineering label
- BPR should be a deliberately planned endeavour
- Start small
- The focus should always be the customer
- Agreement on redesign before setting cost saving targets
- Inclusion of key functions and personnel as early as possible
- Study and highlighting of linkages between projects
- Use of systematic approach to managing change

The key critical factors: executive commitment and leadership, an effective reengineering team, and reengineering technology and methodology.

7.5 INNOVATION MODEL FOR BUSINESS REENGINEERING

Creation of a model of process innovation resulted from the need to handle reengineering work more systematically and thoroughly. As the model handles process innovation at conceptual and theoretical level, it is called the *basic model of process innovation*. The purpose of this model is to improve assessment of process innovation initiatives and thus support innovation management by the following means:

1. Analyse the effects of innovation candidates on business and manufacturing processes.
2. Explain performance changes of processes, and of the whole enterprise.
3. To show the procedure of transforming initiatives to completed innovation. The basic model tends to describe the essence of innovation and linkages in industrial innovation.

7.5.1 Elemental Structure of the Model

Figure 7.4 illustrates the outline and items to be examined in accordance with the model of process innovation. The model includes two main flows of action. The top-down flow is called *work flow of reengineering*, and the elements of reengineering are divided into *background*, *process* and *outcome elements*. The left to right flow describes the basic relations between the core elements of the model. Examination of the basic model is carried out by contents description of each element along both main flows. After that, the relations R1 and R2 (defined in Figure 7.4) are examined in detail.

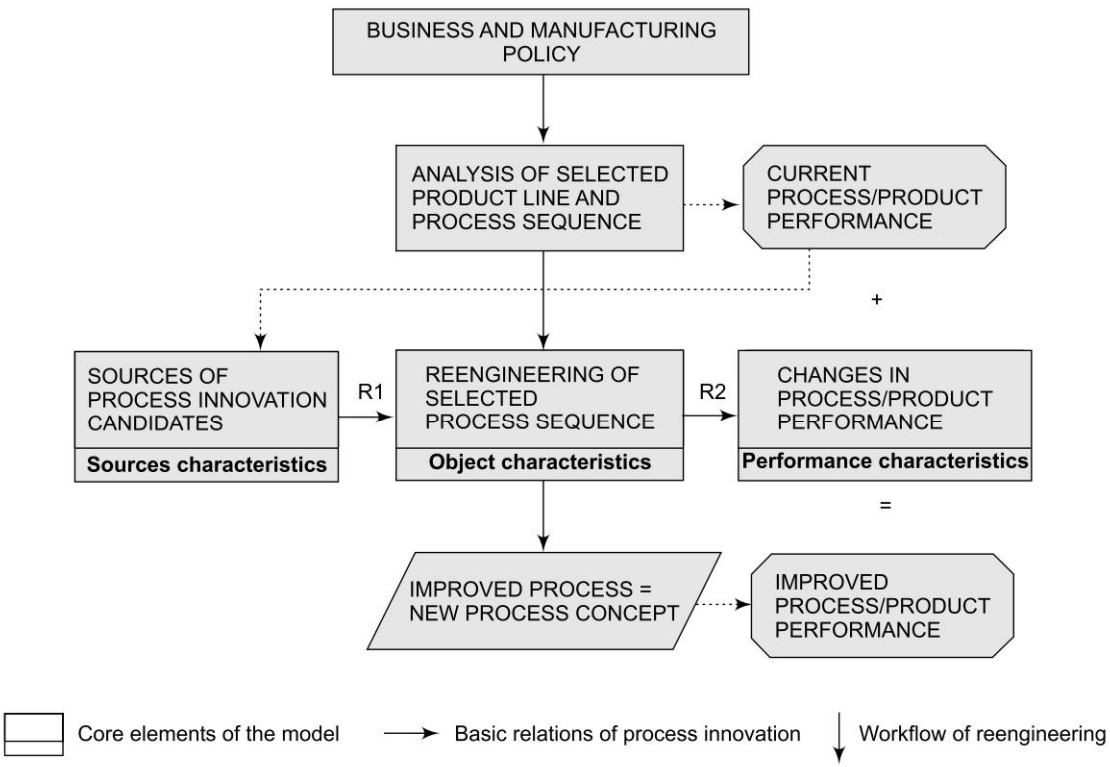


Figure 7.4 *Basic Model of Process Innovation*

7.5.2 Workflow of Reengineering

Reengineering of business and manufacturing is the target of process innovation. The work flow of reengineering in this model consists of three elemental phases: background, process and outcome elements. Background elements of reengineering serve as preliminary phases in using the model, and they are shortly reviewed as:

1. Policy directs the organization and sets guidelines for the development activities of product lines and process sequences in a manufacturing system.
2. Analysis of current state is made for selected product line and process sequence. The purpose of analysis is to specify internal shortages in the selected process sequence and produce performance description of products and processes.
3. Current product/process performance can be described by analytical process matrices, that can be used as one source pool for finding innovation candidates.

Process element of reengineering contains structural, operational and managerial characteristics, which can be classified as follows:

- Process type: job shop, batch, repetitive, etc.
- Product structure/modularity
- Process integration: product line, group, cell, etc.
- Operation type: manufacturing and assembly activities, design activities, sales activities, logistic activities, accounting and financial activities
- User closeness of information: process information systems
- Management and control: decision support and information systems

Outcome elements of reengineering show the potential results of the accomplished innovation procedure. It is based on the comparison of competing innovation candidates and process concepts. The main result of using the model as reengineering aid may include the following:

1. New and improved process concept, and assessment of the opportunities to achieve it
2. Improved process/product performance, and a new competitive level for the whole company

After this procedure of assessment, we may proceed to the process innovation plan and begin to the reengineering process.

7.6 INTEGRATED ENTERPRISE MODEL

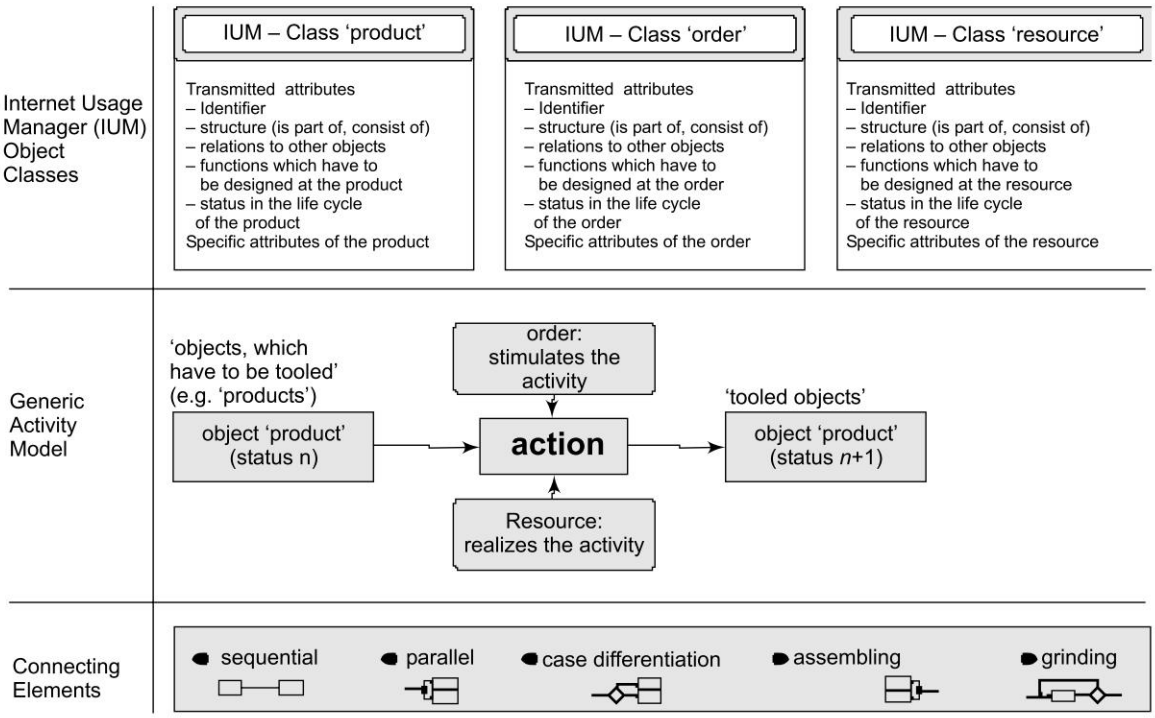


Figure 7.5 *Integrated Enterprise Model Elements*

This method employs the object-oriented approach to describe information and functions of objects on a single model system. The core of the model structure contains the views *business process model* and *information model*. In the model, the manufacturing processes and all activities that, in reality, are related to the production are described by functions and business processes that refer to certain objects. The basis for the development of the model as a description of an individual company is formed by the object classes *product*, *resource* and *order*. The required corporate data and functions are assigned to these objects when creating the model. The relations between the objects are also determined. The result is that all tasks, the process organization, the corporate data, the production facilities and all components of the information system are registered comprehensively on any desired level.

The view *business process model* emphasizes the tasks and business processes that are executed on the objects; the view *information model* emphasizes the structures and features that describe objects. To support the multitude of relevant information

and description requirements of individual sections of the company, one is enabled to view an integrated model of the company from different angles. Business processes and the related information are described integrally in a model core. The information systems, the organizational structure, quality requirements and quality profiles constitute user views that relate to the model core. This enables the user to evaluate process organizational alternatives or modifications with regard to the effects on the control, the quality, the system support, the organizational structure and the staff's qualification profile. Figure 7.5 gives an overview of the modeling elements of IEM. The object oriented modeling approach secures the reusability of modeling constructs and models for different purposes and enterprise types.

Summary

For implementing reengineering successfully in different kinds of industries, multiple models have been developed and executed. The chapter discusses many applied models of BPR, including ARTEMIS model, SHAMASH model, etc. Different phases of the models, workflow interface present, simulation & modeling subsystems are discussed. These models will be helpful to understand the basic elements associated with the reengineering process and with BPR.

Review Questions

1. What is the basic difference between the models discussed in the chapter? Select a firm of your choice and execute any one of the models for performance enhancement.
2. On what basis would you select the model for your firm?
3. Describe the drawbacks of each model.
4. Which model would you suggest for a manufacturing and service firm?

Suggested Readings

Alter, R., Borrajo, D., Camacho, D. and Alonso, A.S., 'A Knowledge-based Approach for Business Process Reengineering–SHAMASH', *Knowledge-Based Systems*, vol. 15, pp 473–483, 2002.

Castano, S, Antonellis, V.D. and Melchiori, M., 'A Methodology and Tool Environment for Process Analysis and Reengineering', *Data and Knowledge Engineering*, vol. 31, pp 253–278, 1999.

Gunasekarap, A. and Ichimurab, T., 'Business Process Reengineering: Modelling and Analysis', *International Journal of Production Economics*, vol. 50, pp 65–68, 1997.

Mertins, K. and Jochem, R., 'Architectures, Methods and Tools for Enterprise Engineering', *International Journal Production Economics*, vol. 98, pp 179–188, 2005.

Motawani, J., Kumar, A. and Jiang, J., 'Business Process Reengineering—A theoretical framework and an integrated model', *International Journal of Operations and Production Management*, vol. 18, 9/10, pp 964–977, 1998.

Papinniemi, J., 'Creating a model of process innovation for reengineering of business and manufacturing', *International Journal of Production Economics*, vol. 60, pp 95–101, 1999.

8

BPR IMPLEMENTATION AND SUCCESS FACTORS

Learning Objectives

This chapter will help the reader in

- Analysing the steps involved in the BPR initiative
- Understanding the five step methodology by Thomas H Davenport
- Identifying the success factors of BPR
- Understanding the reasons for BPR project failure and success
- Exploring fundamental management processes involved

8.1 INTRODUCTION

An exercise in business process reengineering requires a fundamental redesign in the way we work. This is a process of exploration and discovery of clearly defined methodologies and procedures. In this chapter, we look at methodologies for accomplishment of BPR initiatives.

8.2 FUNDAMENTAL MANAGEMENT PROCESS

According to this view, the steps to be followed in a BPR initiative are as follows.

1. Define This step involves defining functional objectives, determining functional management strategy to be followed in streamlining and standardizing processes and establishing process, data and information systems baselines from which to begin process improvement. A framework is established by defining these baselines, objectives and strategies for the function.

2. Analyse This involves analysing business processes to eliminate Net Value Added (NVA) activities, simplifying and streamlining limited value added processes and examining all processes to identify more effective and efficient alternatives to process data and system baselines.

3. Evaluate This means evaluating alternatives to baseline processes through a preliminary functional economic analysis to select a preferred course of action.

4. Plan This step involves planning implementation of the preferred course of action by developing detailed statements of requirements, baseline impacts costs, benefits and schedule.

5. Approve This involves extracting from the planning data the information needed to finalise functional economic analysis, which is used by senior management to approve proceeding with the proposed process improvements and any associated data or system changes.

6. Execute This means executing approved process and data changes and providing functional management overview of any associated information system changes.

The following section defines the implementation process for reengineering.

8.3 FIVE-STEP METHODOLOGY

This was suggested by Thomas H. Davenport of Ernst and Young and James Short of MIT Sloan School of Management in the *Sloan Management Review*, Summer 1990.

They recommended a practical five step methodology to implement reengineering. The five steps required to be traversed by organizations are given in Figure 8.1. Reengineering initiative requires an approach that would bring the needed and the desired outcomes into sharp business focus.

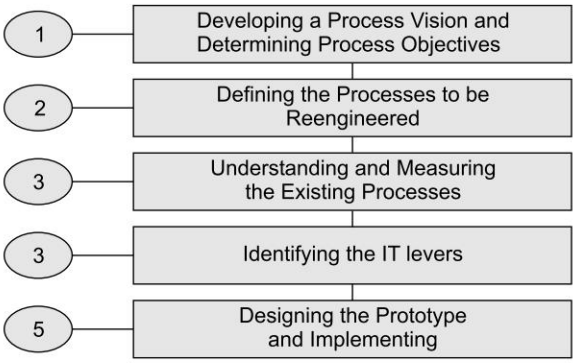


Figure 8.1 *Five-Step Methodology to Implement BPR*

8.3.1 Step 1: Developing a Process Vision and Determining Process Objectives

Reengineering calls for redesigning and simplification of business processes, as mentioned in Chapter 2. The process is defined as a collection of activities which creates an output of value to the customer and often transcends departmental, emotional or functional boundaries. Some processes are extremely critical for the success and survival of the enterprise. Reengineering should provide competitive advantage to the enterprise. Hence, it is necessary to start from the organization's business vision and derive the process that can best realize that vision.

The business vision invariably focuses on future competition, products, customer's expectation in the years to come, and how the enterprise plans to succeed in that environment. In other words, starting a reengineering exercise from business goals preserves the focus on the customer and ensures that processes (along with corresponding attributes and measures) selected for reengineering add value to the organization in addition to being significant to internal procedures and controls.

This step of process vision has to take place at the senior level in the enterprise where the business is perceived as an integrated whole, rather than the sum of departmental or functional activities with conflicting interests and objectives within the enterprise.

Development of process vision essentially recommends the following:

1. Business vision and goals/market/customer driven, and contain the survival values and critical success factors of the enterprise

2. Achievement of business vision may require reengineering of more than one process
3. Process attributes (cost, quality, time, etc.) and process measures ('half the cost', 'in a day', etc.) need to be derived. They can be the locomotive force providing right direction and speed to the reengineering project. At the end of each step, one should have clear answers to the following questions:
   - What are the key processes (identification)?
   - How will the reengineering process perform qualitatively and quantitatively (Vision and objectives)?

8.3.2 Step 2: Defining the Processes to be Reengineered

After identifying the processes, it becomes necessary for execution to develop and establish a common understanding of each process across different levels in the organization. The order fulfillment process is shown in Fig. 9.2. This process clarifies the points where the process starts and ends. In other words, it provides clarity. Benchmarks can be set for different levels, for example:

- Every customer order to be acknowledged within 12 hours (Query response)
- When an item is available in stock, it should be shipped within 24 hours to reach the destination within a week (Order fulfillment for items in stock)
- If the item is not in stock, it should be procured, or manufactured, and shipped

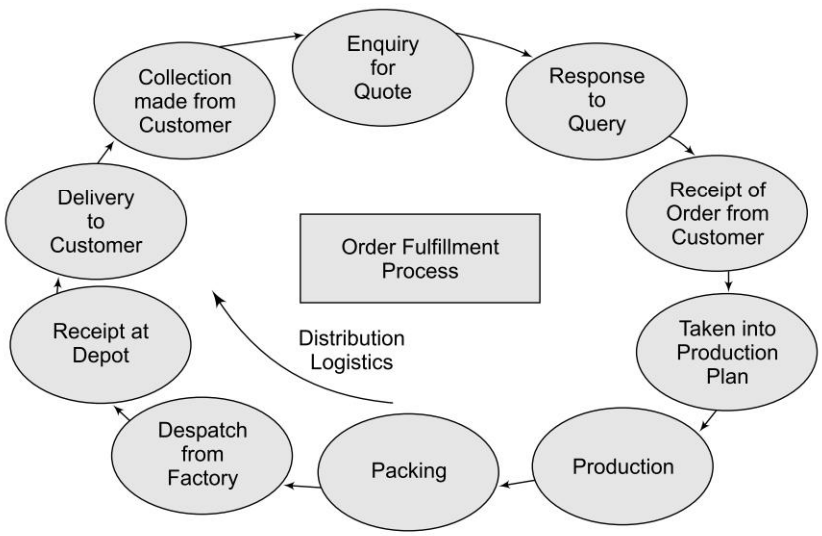


Figure 8.2 *Order Fulfillment Process*

Managers must often focus on the tasks, functions and structures that are not adapted to comprehend the process. To create an output of value to the customer, the process, many a times, has to transcend departmental or functional boundaries. This requires a change in the mindset of managers to tune to the process flow.

While *Total Quality Management* (TQM) has gained rapid acceptance, some enterprises have adapted the concept of internal customer, i.e., to bring in customer orientation in all functions/departments in the enterprise. For example, shipping department becomes an internal customer to production, which, in turn, becomes internal customer to production planning or order process department. This concept provides an opportunity for each department to realize and appreciate *what it means to be a customer* and also *what it means to be a supplier*. If all internal suppliers in the organization keep their commitment to internal customer, then the requirements of internal customer would automatically be met. If the internal customer is unhappy then there must at least be one unhappy external customer. However, caution has to be exercised in the concept. We should not, for instance, have displeased 'real customers' and have a lot of happy internal customers. In other words, the internal customer should not occupy the minds of each task group or function to such an extent that gradually the real customer becomes 'external' to everyone. It is important to develop a process as a set of activities that add value to the customer. Suppose, while cutting the order process time by 1/2 and manufacturing time by 2/3, we still have not met the delivery commitment to the customer, it means we have not visualized any process and have done no reengineering. Clearly defining the given process yields valuable benefits, thus creating early vision of the reengineering process in the departments covered by the process. It also helps in eventually identifying the owner of the reengineering process.

8.3.3 Step 3: Understanding and Measuring Existing Process

This has to be taken up only after creating the vision and identifying the processes to be reengineered. If not, poor performance levels of the existing process may inhibit from aiming high enough to achieve dramatic improvements, which is the essence of any reengineering initiative. For example a hospital wanting to cut down patient waiting time should have correct information on the current average waiting time.

8.3.4 Step 4: Identifying the IT Levers

Every reengineering effort is also an initiative in process improvement. However, reengineering can be different from any other process improvement on the basis of two key factors:

- Reengineering should lead to a dramatic improvement in process performance on selected measures

- Reengineering should end up achieving process obliteration through effective or innovative deployment of information technology

IT should be used as a tool to speed up or support the existing processes in the context of reengineering initiative. It can be a tool to simplify the process through obliteration, wherever possible.

8.3.5 Step 5: Designing the Prototype and Implementing

This is the last step in the reengineering process. This is where the 'owners', who would construct the reengineering process, are created. This is referred to as 'action'. In other words, the organization would start growing into a full grown tree from a seed at the beginning of Stage 5. The earlier four steps would have identified to the organization the ones which matter most in the market place. The essentials of reengineering process should show whether the IT levers used are clearly spelt out. From this stage onwards, it is more than a process to ensure that the sapling grow into a full fledged tree. It requires senior management to bridge the resource gaps in terms of personnel, skills and technology, thereby creating a conducive climate. This stage is unique to each organization and project since this is multidimensional in nature. Issues relating to managing technology, changing people's attitudes and mindsets, creating new organization structures and managing the entire change process would have to be handled. The organization may create ownership through prototypes. They may be valuable in working on mindsets as they provide a learning environment for people to adapt to the new system, and prototypes can also be tuned as required.

8.4 BPR SUCCESS FACTORS

The factors discussed here are the outcome of studies conducted across a number of organisations. They are collection of conclusions drawn from reengineering projects. They are discussed below:

Support by Top Management Changes to process, technology, job roles and work place culture affect business process and require resources. Top management support is essential, failing which, success is remote.

Strategic Alignment Strategic alignment is required with the company's strategic direction for reengineering projects. This capability should be demonstrated through financial performance, customer service and organisation vision.

Communication for Change The initiator should be in a position to communicate the need for change very briefly. The communication should cover

such aspects as critical points, correct state, vision and plan, measurable objectives and the time and resources required.

Established Methodology Established methodology should not only meet the needs of the project, but also be understandable and executable by the BPR team.

Successful Change Management Successful change management is a prerequisite for BPR. Change management is the discipline of managing change as a process. It involves leadership with open, honest and frequent communication.

Process and Line Ownership Organizations need line ownership in order to be aware that they need help to contribute their knowledge. Simultaneously, they need the expertise and objectivity of the persons external to the organization. Hence, the level of engagement and accountability should be clearly defined and distinguished between the internal process owners and external consultants.

Composition of Team The reengineering team should be a mix of members who do not know the process and those who know it completely. The team may include customers, technology professionals, best associates, outside stakeholders, a team leader and cross functional resources.

8.5 BUSINESS PROCESS REENGINEERING: KEY SUCCESS FACTORS

1. A taskforce should be set up to select and structure all processes, and to conduct process review
2. Prices should cover the complete sequence of activities
3. Objectives should be set up from the customers' viewpoint
4. Existing processes should be measured
5. One person should be appointed who is responsible for reengineering process, and implementation management
6. The process should be engineered from a scratch rather than reengineered
7. A top-down approach to process mapping should be chosen
8. All functions should be involved
9. Performance measures should be set for each participating function
10. Decision making teams should be set up for each process, and the whole programme
11. There should be top-down commitment
12. Organization should have realistic expectations

13. The workers should be empowered
14. Organization should follow sound management practices
15. There should be right resources
16. There needs to be tolerance to change
17. Proper budget provisions should be made

8.6 BPR PROJECT FAILURE AND SUCCESS REASONS

BPR projects fail due to:

- Absence of sustained management, commitment and leadership
- Unrealistic scope and expectations
- Opposition to change
- Wrong sponsor
- Cost cutting focus
- Narrow technical focus
- Bad financial condition
- Too many projects underway
- Lack of optimism

Most failures of reengineering are attributable to the process being viewed and applied at the tactical, rather than strategic levels.

The ultimate success of BPR depends on the people who carry it out, and on how much they are motivated for creativity, and for applying their specialized knowledge to the redesigning of business processes.

SUMMARY

In this chapter, we have discussed the steps to be followed in a BPR initiative. We have discussed in detail the five step methodology suggested by Thomas Davenport and James Short for BPR. Developing a process vision and determining process objectives, defining the processes to be reengineered, understanding and measuring the existing process, identifying the IT levers and designing the prototype and implementing. We have also discussed in detail the success factors of BPR and reasons for BPR project failure and success.

Review Questions

1. According to the fundamental management process. What are the steps involved in a BPR initiative?
2. Write the steps for implementing BPR, as given in the fundamental management process.
3. What are the steps for implementing BPR as suggested by Thomas Davenport and James Short? Explain, using a diagram.
4. Define a process.
5. How do you develop a process? Give examples from the Indian context.
6. What is meant by understanding and measuring existing processes?
7. How are IT levers identified?
8. How are prototypes useful to an organization?
9. Discuss in detail the success factors of Business Process Reengineering.

Suggested Readings

Davenport T.H. and J.E. Short, 'The New Industrial Engineering: Information Technology and Business Process Redesign", *Sloan Management Review,* vol. 3. 1 (4), pp 1–27, 1990.

Radhakrishnan R. and S. Balasubramanian, *Business Process Reengineering*: *Text and Cases*, Prentice-Hall of India, 2008.

9

FUTURE COURSE OF BPR IN INDIAN ORGANIZATIONS

Learning Objectives

This chapter will help the reader in

- Understanding how to nullify the risk of failure of BPR in Indian manufacturing organizations
- Discussing the steps in designing the BPR services for small and medium manufacturing firms
- Development of productivity scale
- Framing implementation specifications
- Realizing improvement at the bottom line

9.1 INTRODUCTION

Globalization has brought down the barriers of discriminatory trade. As a result, flexibility and responsiveness in trade have emerged as the only available alternatives. Competitive environment, generated by opening of national economy and globalization is the greatest challenge faced by management in India. Large manufacturing enterprises are able to cope with the fast changing market scenario because of availability of resources, but small and medium sized manufacturing enterprises are facing a difficult situation. On one hand, multinational companies have made deep inroads in the national business scene. On the other hand, economic policy has changed. This has compelled corporate management to think seriously about reengineering strategies that enhance the industrial firm's capabilities in reducing operation costs and cycle times, and help produce high quality products and services.

9.2 EXPECTED COURSE OF BPR IN INDIAN ORGANIZATIONS

A number of elements, such as structural arrangement and lack of appropriate technologies, enhance the risk of failure of reengineering in Indian manufacturing enterprises. The risk of failure may be influenced by unfeasible and ideal specifications of BPR methodology, lack of proper diagnosis of process performance and resistance to change. Tailoring 'delivery to need' course of BPR can nullify all kinds of risks and can provide competitive advantage to Indian enterprises in the global market. Some steps are proposed to achieve this aim:

- Designing BPR services for small and medium sized manufacturing firms
- Translating business reengineering into bottom line results
- Using simulation in BPR application

9.3 DESIGNING BPR SERVICES FOR SMALL AND MEDIUM SIZED MANUFACTURING FIRMS (SMEs)

A performance scale that evaluates the performance of small and medium sized manufacturing enterprises periodically and gives them relevant diagnostic outlines about their present performance status needs to be developed. Due to nonevaluation of their condition, a majority enterprises think about performance enhancement techniques only when they are almost at the sickness level. Thus, there is need for specification of BPR methodology in empirical terms, realization of bottom-line results and regular corporate performance evaluation for Indian SMEs. This course is proposed to meet techno-management prerequisites with reference to the Indian scenario. The course for SMEs should be designed in terms of effective resource

utility, efficient processing and aimed output to achieve the desired level of competitiveness and sustain techno-economic pressure.

9.4 DEVELOPMENT OF PRODUCTIVITY SCALE

For development and characterization of productivity scale for SMEs, the proposed course is organized in the following order (Figure 9.1).

Literature Review This involves review of relevant literature on productivity management, manufacturing enterprises, system engineering, sickness parameters, forecasting techniques, etc.

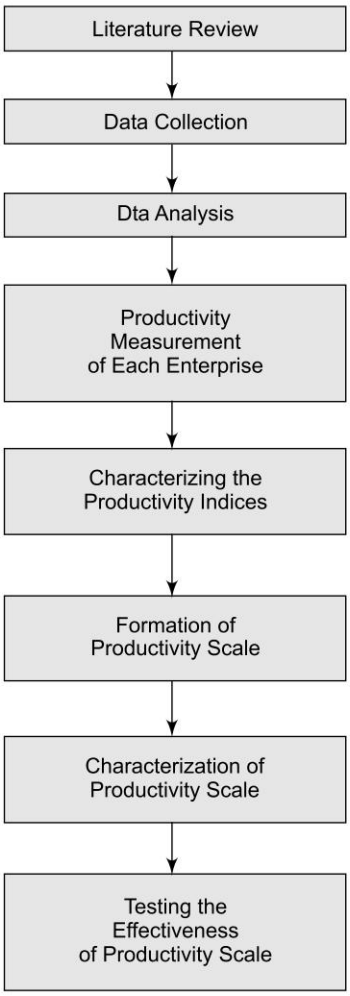


Figure 9.1 *Development of Productivity Scale*

Data Collection This aspect of research concentrates on data collection in terms of turnovers, investments, partial investments of at least 10 manufacturing enterprises of each class of industry, and of last seven years. Only enterprises that are not able to meet targets are selected.

Data Analysis The causes of high and low investments are noted through questionnaires and interactions for selected enterprises.

Productivity Measurement for Each Enterprise This section elaborates the total and partial productivity index for the selected enterprises, and for the last seven years, by applying suitable productivity measurement model.

Characterizing the Productivity Indices In this phase, the calculated mathematical values of total and partial productivity indices for each selected enterprise, and for last seven years, is diagnosed, in terms of outlined conclusions, in a detailed manner.

Formation of Productivity Scale The calculated productivity indices of each enterprise, and of each year, are arranged in an increasing order, where minimum value (sickness level cut-offs) are also mentioned.

Characterization of Productivity Scale The detailed summary of reasons pertaining to each productivity index are framed in table format.

Testing the Effectiveness of Productivity Scale Finally, the figures of investment and turnover of some new enterprises are transformed into productivity index. The mathematical value of this productivity index helps in finding reasons of good/poor performance of that enterprise through *Developed Productivity Scale.*

The reasons for the productivity index occurrence are available in tabulated form, and may be cross-examined by the concerned enterprise. The feedback of the concerned enterprise is used to check the authenticity and correct the productivity scale.

9.5 FRAMING IMPLEMENTATION SPECIFICATIONS FOR REENGINEERING

This aspect of BPR describes its methodology of implementation in SMEs. The elements of methodology are '*empirical framework for performance evaluations in terms of scope, structure, tools, participants, outputs, delivery mechanism and areas of application*'. These elements describe the implementation terms. This course seeks to explore empirically the problems of implementation of re-engineering and their severity in relation to BPR project success. This exercise may address how such technologies can enhance an industrial firm's capabilities in implementing radical reengineering

strategy. The implemental specifications can be framed according to the following steps (Figure 9.2).

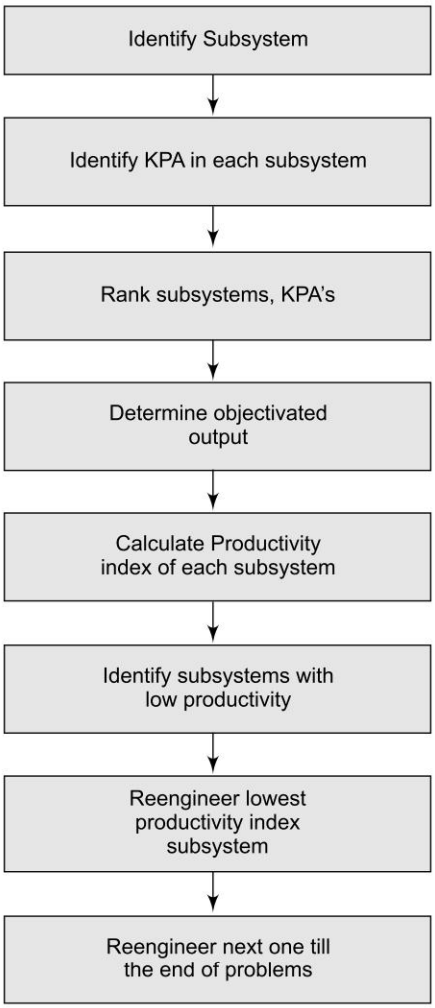


Figure 9.2 *Execution of Reengineering Exercise*

9.6 REALIZATION OF IMPROVEMENT AT THE BOTTOM LEVEL

It has already been pointed out that reengineering is not effective within a broad framework as it does not show improvements at the bottomlines. Case studies show that organizations treat reengineering of one victimized area as the end of the reengineering project. Such incomplete study does not show complete improvements at the bottomlines.

To achieve this target, all victimized areas should be treated one by one, up to nano operations.

Literature Review This phase can provide a review of relevant literature on different aspects of BPR concept as per the latest developments in the concerned field.

Define the Objectives Before the implementation of reengineering, the goals should be framed and evaluated for the enterprise.

Data Collection The existing performance of an enterprise should be evaluated, before the implementation of BPR project. Therefore, the data about each aspect of manufacturing enterprise should be collected with the help of operation process chart, flow process chart, flow diagram and multiple activity charts etc. Right from the beginning of manufacturing to the consumption of product in the market, every step will be noted down. The number of subsystems of an enterprise can be considered, as follows—

(a) Nature of raw material
(b) Vendor Selection
(c) Management Attitude
(d) Incoming inspection
(e) Inventory control
(f) Plant layout
(g) Factors affecting the plant location
(h) Product flow
(i) Processing Sequence
(j) Information system
(k) In process inspection
(l) Organization structure
(m) Worker's Strength
(n) Role of Production, Planning and Control
(o) Product Design and Development
(p) Processing Techniques
(q) Quality Control
(r) Technology
(s) Final Inspection
(t) Customer's Response
(u) Market Demand

Data Analysis The available data regarding different spheres of an enterprise, will be analyzed through causes and effect diagram, critical path analysis, fault tree diagram, Bar Charts, Histograms, Taguchi Method, Scatter diagram etc. The root causes of output should be highlighted.

Problem Definition Based on available analysis of industrial data, the problem responsible for the trouble of an enterprise should be defined in conceptual and mathematical terms with the help of modeling technique.

Designing New Versions Multiple versions of radical redesigned solutions will be proposed by the use of suitable Reengineering tools and techniques like total quality management, just in time, work study, operation research, group technology, industrial engineering techniques, new managerial philosophies in manufacturing etc.

Selecting the Best Version Out of available designed solutions, the optimum one should be picked. The inclination of concerned management will also be considered.

Steps Proposed for Implementation As per the selected version, the stages can be proposed to implement BPR in the focused area.

The previously mentioned implemental and methodological aspects of reengineering can be portrayed in an understandable and elaborative manner, so that any SME can think about adoption of this concept enthusiastically.

A summarized plan is proposed, as shown below:

1. **Identify Subsystems:** Vrat, Sardana and Sehay (1998) have suggested the following sub-systems.
   (i) Production subsystem (ii) Marketing subsystem
   (iii) Financial subsystem (iv) Technology subsystem
   (v) HRD subsystem (vi) Material subsystem
   (vii) Goods and values subsystem etc.
2. **Identify KPA in Each Subsystem:** *Key performance areas* (KPAs) are those areas where high performance is desired. Vrat, Sardana & Sehay (1998) have explained them as:
   (i) In production subsystem, these may be work force utilization, assets utilization, materials utilization, schedule completion, quality of production, production planning and control, etc.
   (ii) In marketing subsystem, these may be sales, market research, product strategy, sales promotion, etc.
   (iii) In financial system, KPAs may be accounts receivable, accounts payable, costing and budgetary controls, taxation, etc.
   (iv) In technology subsystem, KPAs may be design and development, production engineering, research and development/innovation, etc.
   (v) In HRD subsystem, KPAs may be industrial relations, personnel administration and training, etc.
   (vi) In material subsystem, purchase management, stores management and inventory control are treated as KPAs.
   (vii) In goods and values subsystem, the relevant KPA's may be financial goods, investor satisfaction, employee satisfaction, customer satisfaction, supplier satisfaction, societal goods, etc.
3. **Rank Subsystems KPAs:** In each subsystem, these KPAs are ranked according to the priority of performance objectives. Similarly, subsystems are also ranked according to their direct impact upon output.

4. **Determine Objectivated Output:** The goals to achieve are determined qualitatively and quantitatively.
5. **Calculate Productivity Index of each Subsystem:** Productivity Index is calculated for each key performance area. It helps in clarifying the weak and strong areas.
6. **Each subsystem is Evaluated in Terms of Productivity Index:** The subsystem that has many performance areas that need improvement and is directly affecting the desired output, is treated as priority for reengineering.
8. **Reengineer Next one Till the End of Problems:** This process of reengineering is recommended till the end of the disease. By considering nano operations in all spheres of the enterprise, BPR application is made more effective and the organisation becomes highly efficient.

Summary

Majority of Indian organizations, especially SMEs, are at their initial stage of developing strategic culture. They are yet to take advantage of reengineering paradigm. The above mentioned approaches, if implemented systematically, will benefit the Indian organizations and provide fruitful results. At the end, it is worth mentioning that though the fad of BPR may end, process reengineering, in some form, would be of enduring importance.

Review Questions

1. Describe BPR services for small and medium sized manufacturing firms of Indian origin. Describe a successful case study for BPR of an Indian company and list all the factors of successful implementation of BPR.
2. What according to you is the problem an Indian organization can face in translating business reengineering into bottom line results?
3. Take an Indian organization of your choice and measure its productive performance before and after implementing Reengineering. Compare the results, and find the reasons for success or failure of the reengineering exercise.

Suggested Readings

Andrews, Dornie, 'BPR: Diolog, Not Just Design', *Enterprise Reengineering–Nuts and Bolts: Diolog and Design*, 1996.

Busby, J.S. and G.M. Williams, 'The Value and Limitation of Using Process Models to Describe the Manufacturing Organizations', *International Journal of Production Research*, vol. 31, No. 9, pp 2179–2194, 1993.

Champy J.A. and Michael Hammer, 'Business Process Redesign: Tactics for Managing Radical Change'; *Journal of Management Information System*, vol. 12, No. 1, pp 81–107, 1995.

Father, M.M., R. Red, D. Gorgas and B. Modarres, 'The Effects of Complexity on BPR: Values and Limitations of Modelling and Simulation Technologies', *Winter Simulation Conference*, pp 1339–1345,Winter 1998.

Hammer, M. and J.A. Champy, 'Re-engineering the Corporation: A Manifesto for Business Revolution', pp 166–183, Horper Collins, New York, 1993.

Hammer, M. and S.A. Stanton, 'The Re-engineering Revolution', *Harper Business*, New York,1995.

King, W.R., 'Process Reengineering: The Strategic Dimensions', *Information System Management*, vol. 11, No. 2, pp 71–73, Spring 1994.

Malhotra, Yogesh, 'Business Process Redesign: An Overview', *IEEE Engineering Management Review*, vol. 26, No. 3, 1998.

Mike, Donovan, 'Business Process Re-engineering', *Intelligent Manufacturing*, vol. 11, pp 12–19, April 1995.

Modarres, M., 'Strategic Change and Industry Environment', *Western Decision Sciences Institute Reno*, pp 34–49, 1998.

Mone, M., W. McKinley and V.L. Baker III, 'Organizational Decline and Innovation: A Contingency Framework', *The Academy of Management Review*, vol. 23, pp 115–133, 1998.

Parnaby, J., 'Designing Effective Organizations', *International Journal of Technology and Management*; vol. 6, pp 15–32, 1991.

Roberts, L., 'Process Re-engineering: The Key to Achieving Break Through Success', Quality Press, Milwaukee, Wisconsin, 1996.

Stoddard, D.B., 'Business Re-engineering at CIGNA Corporation: Experience and Lesson Learner from the First Five Year', *MIS Quarterly*, pp 233–250, September 1994.

Thwaits, Alfred, Neiol Alderman, Paul Braiden, Bill Hills, David Maffin and Roger Vaughan, 'A Frame Work for Business Process Research', *International Journal of Technology and Management*; vol. 9, pp 497–508, 2000.

Vrat, Frem, G.D. Sardana and B.S. Sehay, *Productivity Management:A System Approach*, pp 75–121, Narosa Publishing, New Delhi, 1998.

PART 2

Business Process Innovation

This part comprises the following chapters:

10. Business Process Innovation and Benchmarking in BPR
11. Process Mapping and Change Management

10

BUSINESS PROCESS INNOVATION AND BENCHMARKING IN BPR

Learning Objectives

This chapter will help the reader in

- Understanding the importance of business innovation
- Adopting a holistic approach towards business innovation
- Getting an idea of the factors affecting business innovation
- Knowing the benefits of benchmarking for BPR
- Getting acquainted with the categories and measures of benchmarking

10.1 INTRODUCTION

Business process innovation in any organization can be used for improvements in efficiency, productivity, quality of product, market share, etc. For many organizations, innovation, especially business process innovation, has become important means for ensuring constant growth.

Maintaining a balance between process and product innovation is essential. While customer satisfaction is a key factor in process innovation, that is achieved through improved efficiency, product innovation involves customer support at the risk of costly R&D.

There are many approaches for innovation models that may use information technology, social systems, economic development, or other such systems.

10.2 BUSINESS PROCESS INNOVATION THROUGH OPEN BUSINESS PROCESS MANAGEMENT (BPM)

Business Process Management (BPM) is a holistic approach that focuses on all aspects of the organization and promotes business efficiency and productivity while striving for innovation and flexibility in business. It attempts to continuously improve the business.

Open BPM provides basic foundation for any business with necessary flexibility to facilitate innovation, especially business process innovation. In general, it is helpful if an organization can react to change efficiently and effectively. Process innovation is a special driver of such change. Open BPM thrives in a business environment that encourages creative improvements and innovations regarding operational processes by enabling highest process flexibility at lowest cost level.

10.2.1 Relationship between Open BPM and Business Process Innovation

Innovation, especially business process innovation, is delivered by open BPM because it enables flexibility in business. Directed by the guidelines defined in a business process governance approach, it facilitates delivery of desired business results, especially process innovation, defined in process models. Innovation can be evaluated through new processes in a simulation or prototype model. Then, the enterprise can decide if the idea should be implemented in form of business model or technology innovation.

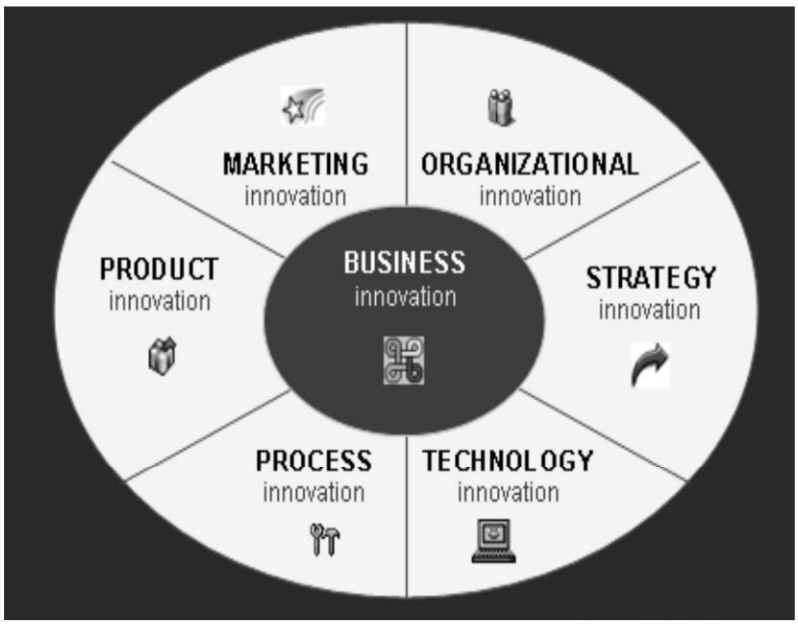
The process monitoring of open BPM provides measurement and control of the effects of process innovation, resulting in a conclusion regarding its success. Additional aspects (For example, compatibility with legal requirements) can also be evaluated through open BPM components.

While open BPM provides the necessary flexibility at low cost for any business, the innovation content that is evaluated and implemented needs to be defined. Market, technology and process developments must be monitored to define the innovation areas to be addressed. For example, a structured formalized market and product description may be very helpful. General strategies, such as real time enterprise or agile organization, or trends like globalization, mobility, etc., may be used to support the definition of innovation focus.

10.3 INNOVATION AND BUSINESS PROCESSES

A wide range of management concepts such as new ways of doing business, changing business strategy to ensure maximum efficiency and productivity, etc., are the driving factors of business innovation.

Major interwoven areas directly related to business innovation are shown in Figure 10.1.



Source: 1000vetures.com

Figure 10.1 *Major Interwoven Areas Related to Business Innovation*

Major areas related to business innovation are:

- **Organizational innovation:** This area involves changing organization processes like knowledge management, work force management, change management,

customer employee relationship, value chain management, finance, etc. The main goal of organizational innovation is to keep a step ahead of changing market conditions, new technologies, and human resource issues.

- **Strategy innovation:** This area involves questioning existing business processes or models in order to meet continuously changing market needs, adding additional values and creating new markets. To survive in today's competitive world, technological and social changes are utmost important. These changes can be implemented if new approaches towards strategy are adopted.
- **Technology innovation:** As technology is a major driving factor in business, technology innovation is directly related to business innovation. It involves innovation derived from research and technology developments that are independent of product and service initiatives.
- **Process innovation:** Increase in profitability, cost reduction, improvement in efficiency, improvement in employee customer relations, employee satisfaction, etc., can be achieved by process innovations. They also deliver enhanced product or service value to the customer. Building *business process management system* (BPMS) is the primary focus of process innovations.
- **Product innovation:** According to Phillip Kotler, a *product* is anything that can be offered to a market for attention, acquisition, use, or consumption that might satisfy a need or want. Thus, a product may be a physical good, retail store, person, organization, place or idea. Product/service innovation is the result of bringing to life a new way of solving the customer's problem—through new product or service development—that benefits both the customer and the sponsoring company.
- **Marketing innovation:** To achieve maximum profit, it is necessary that a proper marketing strategy is adopted by the business organization. So, marketing innovation plays a vital role in business innovation, and, thus, in the success of the business. It focuses on how the industry adapts to new technology and continuous changing customer needs. It is part of business exchange.

For any business to be successful, continuous innovation is required in various areas. It is achieved through a systematic approach towards inventions and discoveries.

10.4 HOLISTIC APPROACH

Innovation arises from complex interactions between organizational entities and the operating environment. Firms that are successful in realizing full returns from their technologies and innovations are able to match their technological developments with complementary expertise in other areas of business, such as enterprise wide business process management, manufacturing, distribution, human resources, marketing and customer service by combining many essential aspects.

Innovation is the key factor in growth, profit and efficiency of a business. Business innovation is made up of many parts: strategy innovation, new product development, creative approaches to problem solving, idea management, suggestion systems, etc. All components are important. In this new era of systemic innovation, every business organization should aim at the holistic approach towards innovation.

10.4.1 6Ws of Corporate Growth

To achieve growth organizations should adopt the principles of 6 Ws. The '6 Ws'– *what*, *why*, *who*, *when*, *where* and *how*—are very powerful words.

I keep six honest serving men
(They taught me all I knew);
Their names are What and Why and When
And How and Where and Who.

—Rudyard Kipling

- **Know why:** Organizations should ask questions like: 'What is the real purpose of your business and Why a business needs to be set up?' Profits should not be the only driving factor for the organizations to achieve success. The objectives of business should include providing value to society. When this objective is lost, organizations lose their ultimate goal of business. Organizations must attain continuous growth by creating new resources, bringing change and innovation into the business according to the changing market conditions. Focus should be on strengthening distinctive factors, leadership, teamwork, processes, knowledge management, etc., that cannot be replicated by competitors.
- **Know what:** Finding the right balance between objectives would help organizations refine their goals. Organizations prosper by achieving strategy through balancing the four major factors or perspectives: financial, customer, process, and growth.
- **Know where:** Remember the old joke about the car mechanic who was called after every other mechanic failed? He listened to the engine for a few minutes, then gave it a hard kick at a strategic spot. Lo and behold! the engine started humming like a kitten. The mechanic turned around and gave the owner bill for $400. The owner was flabbergasted and demanded an itemized breakdown. The mechanic had charged '$1 for his time, and $399 for knowing where to kick.' Hence, it is important for organizations to know the areas where innovation is required so as to achieve maximum efficiency and productivity.
- **Know when:** Timing is an important factor in any business. In addition to defining the areas for innovation and changes to implement, organisations should know when to implement the changes. 'The value of actions lies in their timing,' said Lao Tzu. Customer value and needs keep changing with time, therefore, there is need for continuous innovation and implementation.

- **Know who:** According to Lee Iacocca, 'In the end, all management can be reduced to three words: people, product, and profits. People come first.' People are the most important asset of the organization. Business competitors can copy technology and strategy used by the organization but they cannot take away people.

Organizations are disguised from others based on their products. If products are more value driven and towards customer goals, they will stand out among various products.

At the end of the day, for any organizations what matters is profit. So to attain maximum profit, changes in the innovation are necessary.

Know how: If the organizations do not know how to implement the defined changes, then they end up in losing market value for their products. So, it is of utmost importance that they strategize as to how to implement the changes.

10.5 BENCHMARKING METHODS FOR BPR

Benchmarking is a management tool that helps in identifying the important areas for improvement in any business process so as to achieve maximum productivity and efficiency. It is considered as the initial step in the *business process reengineering* (BPR) and *continuous process improvement* (CPI) efforts. In identifying best practices, benchmarking methods analyse and integrate important performance measures of business processes. Once the areas are identified for improvement, reengineering methods are implemented to improve efficiency and productivity. For this reason, benchmarking has increasingly gained acceptance in the last few years as a technique that enhances BPR efforts within organizations.

10.5.1 Benchmarking Categories

Benchmarking methods can be categorized into four groups. They are:

- Internal (within the business unit)
- Competitive (with competitors)
- Functional (within an industry)
- Generic (between unrelated industries)

Internal Benchmarking *Internal benchmarking* focuses on the fact that organizations should look within their boundaries to improve the processes rather than looking at other organizations. This helps to reduce the amount of time required for benchmarking. In addition, it is often much easier for employees to accept a practice when it is being used within their company.

Internal benchmarking not only helps to identify best practices, it also encourages a culture of learning and innovation spurred on by internal competition. If there is competition within the organization (between employees or between business entities), there will be innovation at all levels of the organization. It promotes idea sharing and increased communication among departments and business units.

In most companies, internal best practices remain unidentified simply because methods for extracting and communicating them do not exist. For internal benchmarking to be effective, a company needs to implement a process designed to promote idea sharing. This can be done in four simple steps:

1. Identify the processes to be benchmarked
2. Organize the benchmarking effort
3. Prioritize the ideas the team finds and turn them into projects with timelines for adopting the best practices
4. Implement and begin to realize the benefits

Competitive Benchmarking *Competitive benchmarking* is a process of comparing a firm's processes, or strategies, or performance measures, with another firm.

Competitive benchmarking helps the organization to know its position as compared to its competitors and helps identify the areas for improvement. This can be in all areas, i.e., finance, products and services, organization, technology, research and development, personnel policies, etc., or in specified areas.

Functional Benchmarking *Functional benchmarking* looks at similar practices and processes in organizations in other industries. This type of benchmarking is an opportunity for breakthrough improvements by analysing high performance processes across a variety of industries and organizations.

Generic Benchmarking *Generic benchmarking*, as a form of external benchmarking, is a performance improvement process that looks at best practices implemented by well established firms. The core area of generic benchmarking is identifying and adapting the best practice to improve productivity by improved performance measures.

Generic benchmarking investigates activities that are, or can be used, in most businesses. This type of benchmarking makes the broadest use of data collection. One difficulty is in understanding how processes translate across industries. Yet, generic benchmarking can often result in an organization's drastic altering ideas about its performance capability, and in the reengineering of business processes.

10.5.2 Pairwise Efficiency Game Formulation (PEG)

In this formulation, a particular unit in the manufacturing process is set as the target unit. By fixing the maximum efficiency to this unit, the efficiency of the other units,

called competitor units, is minimized. Hence, the objective of PEG formulation is to minimize the efficiency score of competitors. The first constraint is equating the target unit efficiency to a fixed value obtained by the Central Contractor Registration (CCR) model. This formulation is run every time by changing the target unit, resulting in $(n-1)$ efficiency scores, where n is the number of units. The mean of all these scores serves as the index of evaluation of different units. The unit with high mean score has good operating practice as compared to the one with lower index score.

PEG formulation enables evaluation of the performance of the manufacturing process by considering multiple inputs and outputs. It allows pair wise comparison of units where the target unit selects optimal weights maximizing its efficiency score and minimizing the competitor's score.

For more information, the reader may refer to the paper by Srinivas Talluri.

10.5.3 Clustering Methods in Benchmarking

A clustering method is used to group together homogeneous objects. This is done by evaluating the objects in multiple dimensions. The analysis is done in a matrix whose columns are objects and the rows contain the attributes for each. Thereafter, resemblance coefficients are computed for each object which acts as the index for grouping the objects. There are many resemblance coefficients, like the *Euclidean distance coefficient* (*ejk*), the *coefficient of shape difference* (*zjk*), the *cosine coefficient* (*cjk*), the *Pearson product-moment correlation coefficient* (*rjk*), the *Canberra metric coefficient* (*ajk*), and the *Bray-Curtis coefficient* (*bjk*).

Based on these resemblance coefficients, the resemblance matrix is formed, and using the cluster method to this matrix, a tree diagram or dendogram consisting of the grouping of similar objects can be obtained. There are several clustering methods, like *the unweighted pair-group average method*, *the single linkage clustering method*, *the complete linkage clustering method*, *Ward's minimum variance clustering method*, and *the centriod method*. In clustering method, initially, each object is taken as a cluster. It proceeds by grouping similar objects based on resemblance matrix into clusters, and proceeds further. The unweighted pair-group method is the most widely used clustering method. This follows simple averaging method. Initially, two objects with highest similarity coefficient are grouped into a single cluster and then the average of this group is taken as the similarity coefficient of this cluster. It identifies other objects that are similar to this cluster and proceeds by grouping them into this cluster.

For more information, the reader may refer to the paper by Srinivas Talluri.

10.5.4 Identifying Benchmarks for Improving Inefficient Processes

Developing and using proper measures to identify the current performance of a process is important. Identifying the current state of the process at various stages

helps to find out the performance gap. It also gives a broad idea about what needs to be benchmarked for better output. If potential areas for benchmarking are identified, it is possible to shape the future strategy of the process, which, in turn, will lead to a quality product.

Besides identifying the areas to be benchmarked, it is important to find out the methods of benchmarking that need to be applied for better output of the product. Benchmarking techniques vary from organization to organization. To implement a particular benchmarking technique, it is important to identify the desired output of the product, the inputs/resources involved and the approach to be followed for obtaining that output.

Summary

Business innovation is the key factor for success in any organization. Factors like technology and product service are not the sole basis for innovation. Innovation depends on the business model. Business model is a broad picture of how an innovative concept would create economic value for the user, and for the firm and its shareholders and partners. It considers the infrastructure required to move the product/service to the market in a manner which is convenient for customers and profitable for the firm.

Business process management (BPM), as a managerial approach, considers the processes or methods that need to be understood and managed properly to deliver quality products and value added services to the customers. In general, BPM integrates changes enabled by technology and humans. Due to this, BPM is always discussed from two different view points—people and technology.

Benchmarking is an effective way to ensure continuous improvement or progress towards strategic goals and organizational priorities. A real benefit of benchmarking comes from the understanding of processes and practices that permit transfer of best practices or performances into the organization. Benchmarking stresses processes, quality, and output, and also the importance of identifying and understanding the drivers of the activities.

Review Questions

1. How does business process innovation play a key role in the success of an organization?
2. How can business process innovation be achieved through open BPM?

3. What are the factors that affect business process innovation?
4. Why is a holistic approach desired towards business innovation? Explain with an example.
5. What is benchmarking and how is it useful in business process reengineering?
6. What are the categories of benchmarking?
7. How can benchmarking be effectively used in identifying an inefficient process and improving it?
8. Discuss a case study in which methods of benchmarking are applied.

Suggested Readings

http://www.1000ventures.com

John Jeston and Johan Nelis, '*Consultants Touch Point*, Business Process Services', Sydney Australia, A paper presented in www.bptrends.com, July 2006.

Srinivas Talluri, 'A Benchmarking Method for Business Process Reengineering and Improvement', *International Journal of Flexible Manufacturing Systems*, October 2004.

International Journal of Flexible Manufacturing Systems, Volume 12, Number 4, pp 291-304.

11

PROCESS MAPPING AND CHANGE MANAGEMENT

Learning Objectives

This chapter will help the reader in

- Understanding how process mapping plays a major role in business organizations
- Getting an idea of work as a process
- Becoming familiar with the scope of SIPOC map
- Knowing the importance of change management; benefits of change management and strategies for change management

11.1 INTRODUCTION

Process Mapping is a workflow diagram drawn for clear understanding of the business events that occur in series or parallel ways. The business events entail what a business entity does, responsibility for occurrence of events, and the factors that need to be incorporated for the success of business and so on. The first step in any business is to find the processes involved in the business. After finding the processes, the next step is to build a logical connection between them. This will have direct impact on the business operations. Process mapping also tells how major functions of the business interact with one another and the manner in which they can be improved.

Maps and flowcharts, used in process mapping, help in better understanding of the processes. If the processes are visible and understood properly, they help in improving strategies towards their implementation, improve customer satisfaction by finding methods that reduce non-value added steps, contribute towards reduction in costs, help to establish customer driven process performance measures, reduce process cycle time and increase productivity. Systematic and structured approach is necessary towards process mapping.

11.2 IMPORTANCE OF PROCESS

Process can be defined as a sequence of interdependent and linked procedures that, at every stage, consume one or more resources (employee time, energy, machines, money, etc.) to convert inputs (data, material, parts, etc.) into outputs. These outputs then serve as inputs for the next stage until a known goal or end result is reached.

In some organizations, products are given more importance than processes. But, the fact is that the process comes before the product, and for a product to be of good quality the process should be good. Poor process or no process ultimately harms the product.

Business management methods, such as *Six Sigma* and *Total Quality Management (TQM)*, focus on understanding and improving a process. By focusing on process improvement, the business can achieve better results, including customer satisfaction, good financial results and employee satisfaction.

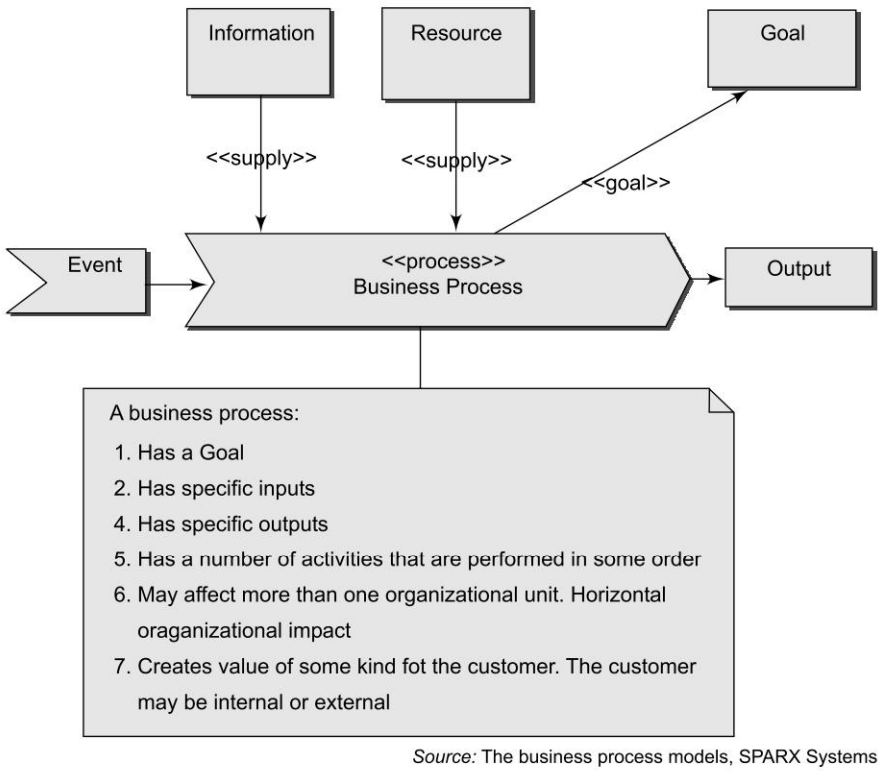
11.3 WORK AS A PROCESS

A *business process* in an organization is a set of processes or activities that integrate with each other to produce a particular product for a particular client, or customer. It emphasizes on how the work should be done within an organization to accomplish a particular goal. The characteristics of a business process are listed below.

A business process:

1. Has a goal
2. Has specific inputs
3. Has specific outputs
4. Uses resources
5. Has a number of activities that are performed in some order
6. May affect more than one organizational unit–Horizontal organizational impact
7. Creates value of some kind for the customer. The customer internal or external

The factors involved in the business process are shown in Fig. 11.1.



Source: The business process models, SPARX Systems

Figure 11.1 *Factors Involved in a Business Process*

If the business process is carried out in a systematic way, it would lead to improved efficiency and productivity.

11.4 SIPOC MAP

SIPOC (Suppliers, Inputs, Process, Outputs, Customers) is a six sigma tool. A *SIPOC map*, in any business, helps to develop a high level view of processes, highlights areas of improvements and ensures focus on the customer.

SIPOC map helps the management to quickly define, analyse, prioritize and recommend solutions to certain problems as this map gives a logical connection between various processes/methods of the organization. If a business consists of many entities, SIPOC map gives the inter-entity process logic, thus providing the correct picture of the entire organization. This directs the business towards financial and customer focused goals.

Before the process improvement phase, it is important to identify the relevant elements associated with the business. SIPOC map helps define these elements. It is used at the measure phase of the six sigma DMAIC (Define, Measure, Analyse, Improve and Control) process. The SIPOC inputs and outputs are given in Fig. 11.2.

The elements on the left hand side of the 'process' block refer to the inputs that a normal process will have and the output elements are given on the right hand side of the block. As could be seen, the output can be physical products, documents, information and decisions taken by the organization.

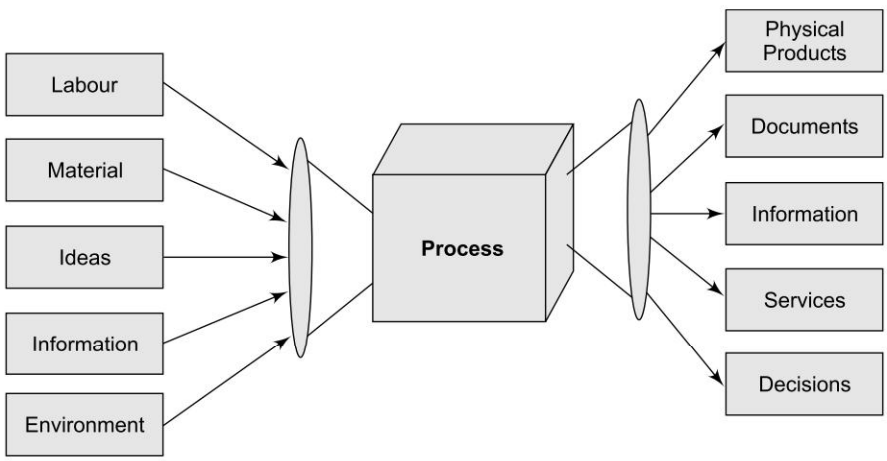


Figure 11.2 *SIPOC Inputs and Outputs*

11.4.1 Steps to Draw a SIPOC Map

The steps necessary to draw a SIPOC map are:

1. Name the process
2. List key inputs and suppliers

3. Identify the boundaries of the process
4. Identify and name major project steps
5. List key outputs and customers

As the SIPOC map gives a complete list of resources (inputs and outputs) associated with the process, it gives the overview of the organization, and also suggests the areas of improvement, thus acting as a key factor in the success of the organization.

Given below are the examples of process mapping along with the process map.

Example 1:

The process of 'car repair' is defined and different inputs and key factors are listed. A SIPOC map is drawn.

Step 1: Name the process

- Car repair

Step 2: List key inputs and suppliers

- Assign the car to a mechanic
- Inspect the car
- Order damaged parts

Step 3: Identify the boundaries of the process

- Estimate repair cost and time
- Get customer and insurance approval

Step 4: Identify, and name major project steps

- Repair of the car
- Inspection after the repair

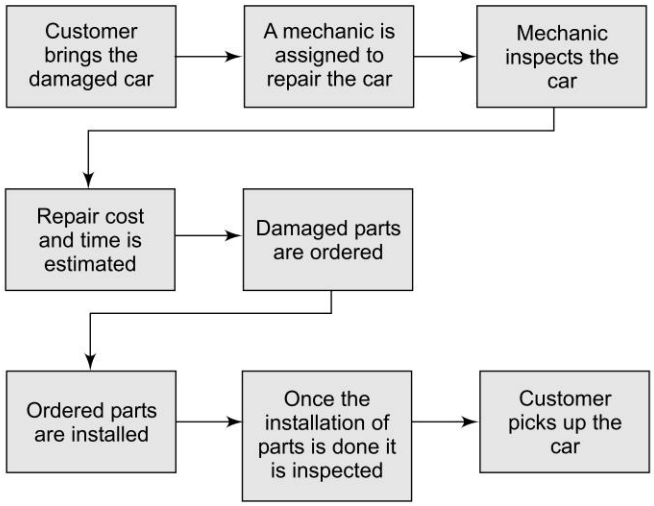
Step 5: List key outputs and customers

- Installation of damaged parts
- Test drive by the customer

The above example can be tabulated as shown below:

SIPOC Analysis ***Process : Car repair***				
Suppliers	Inputs	Process	Outputs	Customers
Car owner	Car	Repair of car	Repaired car	Car owner
Auto parts distributor	Auto parts			Insurance company

Process Map:



Example 2:

The process of 'making a photocopy' is taken and different inputs and key factors are listed. A SIPOC map is drawn.

Step 1: Name the process

- Making a photocopy

Step 2: List key inputs and suppliers

- Customer who takes the photocopy
- Person who makes the photocopy
- Company who supplies paper and toner
- Power company that supplies electricity

Step 3: Identify the boundaries of the process

- Number of photocopies required
- Quality of the photocopy

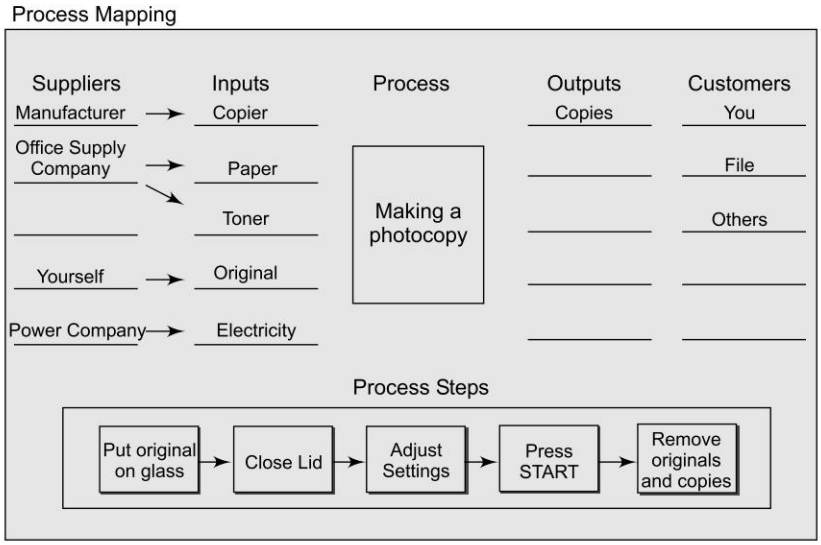
Step 4: Identify and name major project steps

- Photocopying

Step 5: List key outputs and customers

- Photocopies
- Customer who receives the photocopies

The pictorial representation of the above process is shown in Fig. 11.3.



Source: *Process mapping*, CGR Rao, Joint Director, DIQA Bangalore

Figure 11.3 *SIPOC Example*

The SIPOC tool is generally used in the define and measure phases of a Six Sigma project, but it is also useful in training materials, process documentation, or when creating a process from a scratch.

11.5 CHANGE MANAGEMENT

Change management is a set of processes that are incorporated to ensure that significant changes are implemented in a systematic and controlled way to effect organizational change. The main goal of change management is to reduce the risk associated with the implementation of change in the business environment. Its other fundamental goal is rapid recovery of change related problems when changes are implemented. Effective change management achieves these goals without compromising the values of business.

The main factors for change management are the processes/methods in which changes are to be implemented and the tools through which changes are incorporated. Most organizations want change to be implemented with least obstruction to business entities and minimum risk to business. For this, change must be applied with a structured and systematic approach.

In general, change management helps an organization to reduce risk while implementing the change, which is acceptable by the top management. Structured and

systematic approach towards change management strategies can benefit not only financial aspects of the organization, but also information security, operations and risk management functions.

11.5.1 Importance of Change Management

Change management plays an important role in an organization. Identification of changes in the organization or a project may together be initiated internally or externally, in what is more important is how the organization responds to these changes.

It is not easy to make immediate changes to an established process. When more than one process is running in parallel or series fashion, changes made in one process will reflect in another. The change process should be thought of as a process which stops the current process and makes necessary changes to the current process. The new process is then implemented. The procedure should have minimal effect on the process and the business organization.

The change process may also be considered a problem solving situation. The implementation of identified changes may be viewed as solution to the problem identified in the current process or method.

A broad skill set (political, analytical, business, etc.) is required for managing changes in the organization. The top management should evaluate the financial and political impacts of the changes. The workflow should be changed in such a manner as to reflect the financial changes taking place. Operations and systems should be so reconfigured that the organization gets the desired financial impact.

Therefore, we can conclude that change management considers all aspects of the organization before implementing the change. Hence, it plays a vital role in the success of any business.

11.5.2 Action Plan for Change Management

There is increasing emphasis on the need to tailor change management strategies to the business entities of the organization and its environment, and to address all aspects of the organization during implementation of change. Effective change management requires not only skilled management but also effective leadership and broad employee engagement and participation.

Processes and values, that are key factors of any business, can become restrictive factors while implementing the changes. Time and resources play an important role in changing the process. As a process has direct impact on the organization success, it is difficult to implement changes in it. Values influence judgments about the type of business the organization can conduct. Hence, values are also difficult to change.

Processes are not nearly as flexible or adaptable as resources, and values are even less so. So, when an organization needs new processes and values, it must create a new organizational space where those capabilities can be developed in several ways. This may be done by:

- Creating new organizational structures within the corporate boundaries where new processes can be developed
- Spinning out an independent organization from the existing one
- Acquiring a different organization whose processes and values closely match the requirements of the new task

These alternatives obviously have implications for the existing organization as well as the demands placed on the organization's leadership, as illustrated in Table 11.1.

Table 11.1 *Strategies for Enhancing Effective Change Response*

Requirements of New Opportunities	Good Fit with Organization's Values about Type of Business Opportunities	Poor Fit with Organization's Values about Type of Business Opportunities
Poor Fit with Organization's Processes	Use a heavyweight team (the relevant people pulled out from the existing organization act as general managers for the new initiative), operating within the existing organization	Use a heavyweight development team (the relevant people pulled out from the existing organization act as general managers for the new initiative), operating in a separate spinout organization
Good Fit with Organization's Processes	Use a lightweight team (a cross functional team matrixed from the existing positions), operating within the existing organization	Development may occur in-house through a heavyweight team (the relevant people pulled out from the existing organization act as general managers for the new initiative), but commercialization almost always requires a spinout

Source: Christensen, Clayton, M., and Michael Overdorf, 'Meeting the Challenge of Disruptive Change', *Harvard Business Review*, 78(2), March–April, 75, 2000.

Top management participation is critical to the success of change initiatives. Leaders are needed to provide vision, and inspiration, demonstrate integrity, provide meaning, generate trust and communicate values. A key aspect of leaders' effectiveness during change is their ability to apply different styles of leadership to different circumstances, even within short time periods. This is because different leadership styles (coercive, authoritative, democratic, pacesetting, coaching) have different effects on various aspects of organizational climate (flexibility, responsibility, standards, rewards, clarity, commitment) that affect the success of planned change in different circumstances.

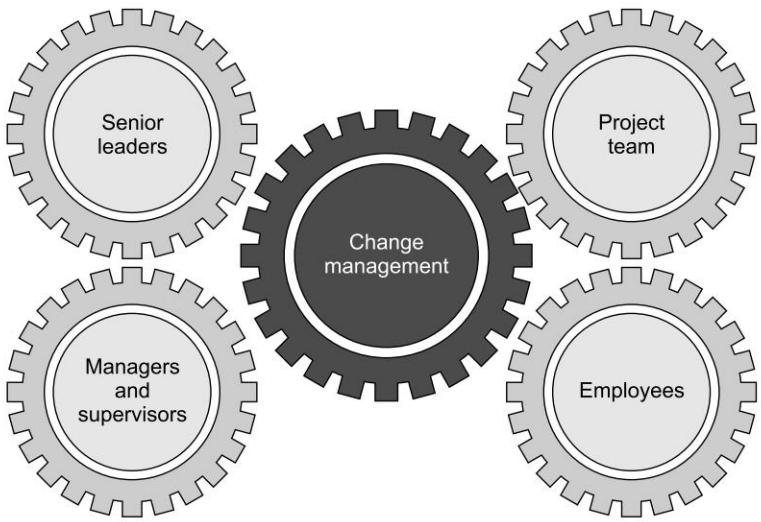
11.5.3 Prosci's Change Management Approach

Prosci is the recognized leader in change management research. Prosci has developed a change management model that is research based and holistic in approach. Prosci's change model and structured process provide a comprehensive framework for all managemet levels.

Organizations choose Prosci's change management approach because the methodologies are:

- Research based
- Holistic
- Easy to use

Prosci's change management approach is explained in Fig. 11.4.



Source: Prosci Change Management Series

Figure 11.4 *Prosci's Change Management Approach*

The Salient features are:

- *Executives and senior managers* actively and visibly support the change, build the coalition, and communicate directly with employees.
- *Supervisors* coach employees through the transition and manage resistance.
- *Project teams* develop change management strategy and plans, and provide support to other employees.
- *Front line employees* survive and thrive during organizational change.

For addressing issues related to change management, Prosci makes use of **ADKAR** (Awareness, Desire, Knowledge, Ability, Reinforcement) model that allows organizations to focus their activities on specific business results. For more information, readers may visit Prosci's website, www.prosci.com.

BPR and Organizational Change BPR is an important change management tool. Most BPR organisations are making significant and wide reaching changes to their organisation in response to strategic business needs.

McKinsey's 7 S Model The model is based on the theory that, for organizations to perform well, seven elements—structure, systems, style, staff, skill, strategy and share values—need to be aligned and mutually reinforced. The model is used for identifying the changes that need to be implemented to improve the performance of the organization.

McKinsey model is used as a basis for assessing the extent to which organisations undertaking BPR are changing them. For more information, readers may refer to the author's book 'Strategic Management—The Indian Context', Third Edition, PHI, 2009.

11.5.4 Practices in Change Management

Before implementation, a change needs to be analysed, defined and approved. Change management contains four stages. They are:

- **Proposing a change:** This phase focuses on the fact that change may be identified and suggested by anyone within the organization. But the key factor is that the change request must include change description, outcomes of change and the expected benefits.
- **Summary of impact:** The overall impact of the identified change is viewed by the top management before giving approval for implementation. The following points may be considered while summarizing the impact of the change:
  - Quantifiable cost savings and/or benefits
  - Estimated cost
  - Impact on timescales
  - Additional resources required
  - Impact on other projects and activities
  - Additional risk and issues

  Based on these points, top management takes decision and implementation of changes.
- **Decision:** This phase focuses on the review of the change request by an authority who takes all relevant information into account before giving approval.

- **Implementing the change:** If the change is approved, it is scheduled, and implemented.

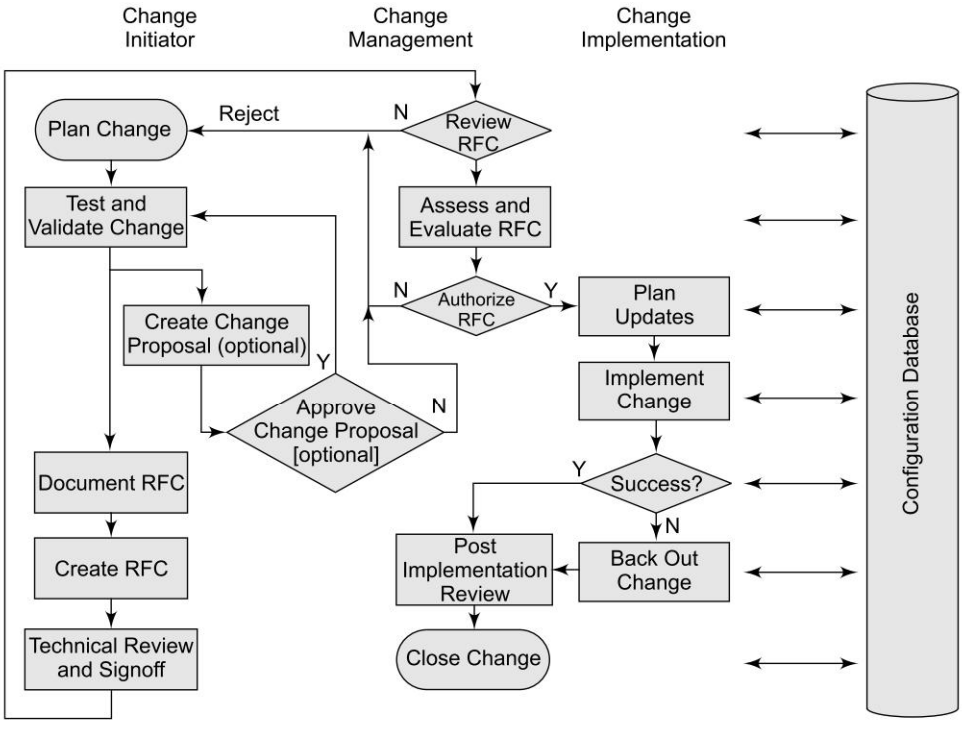
In order to continuously improve and monitor the change process, a *process improvement programme* (PIP) should be implemented. This programme should be:

- Documented
- Continuous and periodic
- Used by management for key business decisions

The goals of the process improvement programme are:

- Evolving a repeatable process for making changes
- Making changes quickly and accurately (driven by business needs)
- Protecting services while making changes
- Delivery of process efficiency and effectiveness benefits

Pictorial representation of a normal process flow in the context of change management is shown in Fig. 11.5.



Source: Change Management: Best Practices, www.cisco.com

Figure 11.5 *Normal Process Flow in the Context of Change Management*

Organizations will find it helpful to predefine change process models and apply them to appropriate changes when they occur. Such a model provides the framework for defining the steps needed to handle changes consistently and effectively.

Summary

A process is a series of activities, occurring within a company, that lead to a specific goal. Business process is a collection of interrelated processes that function in a logical sequence to achieve the ultimate goal. Business process focuses on meeting the needs of the customer by delivering value driven products. It often makes use of process mapping techniques and SIPOC map to achieve high productivity in its products.

The steps of a business process vary from one corporate structure to another. However, there are some elements or sub-processes that can be found in almost all business processes. To some degree, these sub-processes occur in an order that leads to successful completion of the manufacturing process.

Change management is one of the most important processes in the organization. An organization experiences a large volume of changes in its processes and strategies while identifying and implementing them. Change management is even more effective in maintaining changes in service management processes, in particular, configuration management, release management, problem management, and incident management.

A structured and systematic approach towards the change management needs to be followed to monitor and maintain changes.

Review Questions

1. Describe the terms process and process mapping.
2. How is process mapping useful in a business organization?
3. How is SIPOC map useful? Explain the steps involved in drawing a SIPOC map?
4. Illustrate an example in the context of process mapping and draw its SIPOC map.
5. What is change management? Is there need for change management in organizations? Explain with an example.
6. What are the benefits of change management? Illustrate by examples.

7. Why do we need to maintain a change in a business?
8. What are the strategies of change management?

Suggested Readings

SPARX Systems, '*The Business Process Models*', Article, UML Tutorials www.businessdictionary.com, 2004.

Srinivasan, R, *Strategic Management—The Indian Context*, 3rd ed., Prentice-Hall of India, 2009.

www.cisco.com (Change Management: Best Practices)

www.prosci.com

PART 3

Applications of BPR

This part comprises the following chapters:

12. Case Study on BPR on Measures of Competitive Advantage
13. Cases of Successful BPR Implementation

12

A CASE STUDY ON BPR ON MEASURES OF COMPETITIVE ADVANTAGE

Learning Objectives

This chapter will help the reader in

- Reviewing a case on BPR developing measures of competitive advantage
- Understanding the SCORE construct
- Assessing reliability and validity
- Analysing the research findings from the case study

12.1 INTRODUCTION

In this chapter, we propose a set of measures to assess the extent of competitive advantage provided by BPR. It presents a detailed analytical case study done in the Indian context, taken largely from the research work of one of the author's doctoral students. This case study makes use of a number of elements, specifically developed for the purpose of measurement. A set of contracts is developed to facilitate the measurements.

12.2 MEASUREMENTS OF COMPETITIVE ADVANTAGE

Measurements of competitive advantage are necessary for choosing between candidates and change management disciplines and practices in the business planning stage. The risks and long term consequences of these initiatives are assessed through impact assessment. Measures are required to demonstrate and justify the value of these initiatives to top management while making investment decisions.

12.2.1 Importance of Construct Measurements

In *construct measurements*, numerals are assessed to a concept (word that expresses an abstraction formed by a generalization from particulars) that has been consciously invented or adopted for a specific scientific purpose. Measures have to be both reliable (must not vary unreasonably due to irrelevant factors) and valid (should measure what they are intended to). *Management literature* reveals the alternative approaches that exist in developing constructs. Three approaches that are widely used for developing constructs are:

1. Narrative Approach
2. Classificatory Approach
3. Comparative Approach

Narrative approach is a case-based tradition that characterizes that Competitive Advantage should be described only in its holistic and contextual form. While this approach is useful for conceptual development, it has limited use for testing theories of effectiveness and differing environments—organizational and temporal conditions.

In the *classificatory approach*, a conceptual classification term 'typology', was given by Rumelt, Hofer & Schendel, Miles & Snow and Porter. The typologies are rooted in a set of parsimonious classificatory variables or conceptual criteria. The empirical classifications are referred to as *taxonomies* and reflect empirical existence of internal consistent configurations. They are comprehensive and capture the integrative nature of competitive advantage, but do not reflect the 'within group' differences among the underlying variables.

In a *comparative approach*, the key traits or variables of a competitive advantage construct are identified and measured. The focus used is more on measuring the differences along a set of characteristics that collectively describe the construct in question. The process of construct development and measurement forms the core of theory construction.

12.2.2 Research Study

A research study was conducted in the Indian context to develop a set of measures for the construct, Sustainable Competitive Advantage provided by Business Process Reengineering (SCORE). The objectives of this study were:

- To conceptualize a multi-variable construct SCORE
- To develop a set of measures of key variables of the SCORE construct
- To evaluate/analyse the operational measures developed, such that they satisfactorily fulfill reliability and validity properties
- To aggregate these measures into a comprehensive set and develop suggestive norms for SCORE construct

Churchill is one of the early researchers in BPR who is credited with developing measures for constructs and these are modified and used in the present research study to suit the context. The study adopted a comparative approach and aimed at linking conceptual definition and empirical indicators of SCORE.

Steps in Developing Measures of a Construct Figure 12.1 gives the steps involved in developing measures of a construct.

As can be seen, the first step delineates the domain of the construct constitutively and operationally. Whereas the *constitutive definition* defines a construct with other constructs, an *operational definition* assigns meaning to the construct by specifying activities or operations that are required to measure it. However, an operational definition has only limited meaning since an abstract concept can be operationalised and measured in a number of ways. Hence, there is need for a constitutive definition whose generality and abstractness preserve the construct's meaning.

The second step involves review of past literature to arrive at the variables of the construct, and the set of items for each variable. Generally, a construct is measured with multiple items. Use of single items has limitations, like low degree of relationship with, and specificity correlated to, a particular construct; it can categorize an entity into a relatively small number of groups, which is often unreliable.

Initially, data is collected using laboratory experiments, field experiments or survey research.

Refining a measure helps in minimizing measurement errors and increasing reliability. In the domain sampling model, the most logically defensible model, the

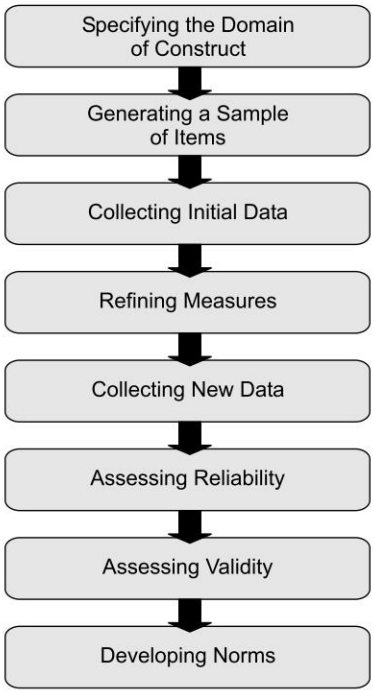


Figure 12.1 *Steps in Developing Measures of a Construct*

purpose of any measurement is to estimate the score that would be obtained if all items in the domain were used. However, in practice, one does not use all items, only a sample of them. The sample of items to the extent they correlate with the true scores is good.

Cronbach Alpha coefficient is one of the important measures used to determine internal consistency. It provides an unbiased estimate. It provides an unbiased estimate. A low alpha co-efficient indicates that the sample of items perform poorly in capturing the construct. As a thumb rule, an item that has nearly zero correlation, and also those that produce a substantial and sudden drop in the item-to-total correlations, should be eliminated.

Factor Analysis, either exploratory or confirmatory, can be used to examine the dimensionality of the construct. *Exploratory Factor Analysis* helps in ascertaining the underlying dimensions of data. Sometimes, the result in the dimension of the factors may not be interpretable. This is partly due to 'garbage items' that do not have a common core and, hence, should be eliminated. However, there are no unambiguous criteria to determine the number of underlying factors. Hence, a conclusion supported by independent criteria, like principal component analysis and maximum likelihood analysis, should be accepted.

Confirmatory factor analysis can help in testing hypotheses with respect to the number of dimensions. It is meaningful when there are specific expectations regarding which variable is likely to load on which factor.

For the construct to have face or content validity the sample of items should be appropriate. Adherence to steps helps in producing content valid measures. The domain sampling model encompasses all errors that occur within the test. This tends to lower average correlation among the items within the test but the average correlation among the items is all that is needed to estimate reliability. Alpha coefficient is used for determining the reliability of a measure based on internal consistency. However, it does not adequately estimate errors caused by factors external to environment, such as difference in testing situations and respondents over time. Hence, new data should also be subject to the same analysis as above and the results should be compared. At this stage, alternative methods of reliability can be employed.

All preceding steps produce an internal, consistent and homogeneous, set of items. This is a necessary but not sufficient condition for ensuring validity of the construct. *Construct validity* refers to the extent to which a measure actually appraises the theoretical construct it connotes to assess. When a measure correlates highly with other measures designed to measure the same construct, there is evidence of convergent validity. Low correlation between the measures considered and other measures not measuring the same construct indicate discriminant validity. *The construct should have both convergent and discriminant validities.* It should also have *predictive validity*, that means the unit should behave as expected in relation to other constructs.

Norms are developed by first aggregating measures to compute the overall score and then developing benchmarks. *Norm quality* is a function of the number of cases on which the average is based and their representativeness. A large number of cases lead to stable norms and more definitive conclusions. Table 12.1 gives major studies involving construct operationalization.

Table 12.1 *Summary of major studies involving construct operationalization*

Area	*Authors, Year*	*Constructs Operationalized*	*Methodology*	*Data Analysis Conducted*
Strategic Planning	Raghunathan & King	IS strategic planning IS systems planning Degree of plan implementation	Multi-item Likert scales Survey of 140 companies using matched pair questionnaires	Reliability analysis Content validity Index by summing
	Sullivan	Infusion of IT Diffusion of IT	Structured questionnaire Survey of 37 US companies	Not discussed

Competitive Advantage	Vitale, et al	Satisfaction with the process of identifying strategic uses of IT Knowledge about IS assets and opportunities	Single item scale Survey of 24 managers 4 item scale	No formal reliability and validity tests No formal tests index by summing
	Zmud, et al	IT penetration IS management processes	4 item scale 42 item questionnaire	Factor analysis and correlation analysis Exploratory factor analysis
		IT related managerial reliance	4 item scale (survey of 132 US firms)	Reliability assessment Factor analysis Convergent validity
	Raho, et al	Organizational problems encountered with change management	Multi-item scales Survey of 44 companies	No reliability or validity tests
	Ginzberg	MIS implementation	71 item questionnaire Data collected from 35 firms	Dimensionality assessed using factor analysis No reliability assessment Index by summing
	King & Epstein	Overall value of information	Single item measure of each attribute Survey of 60 companies	No assessment of reliability validity or indexing
	Bailey & Pearson	Computer user satisfaction	Semantic differential scale Survey of 32 US firms	Reliability of each factor Content validity Predictive validity Construct validity
	Ives, Olson & Baroudi	User information satisfaction	Survey of 280 managers	Factory analysis Construct validation Reliability assessment
	Sanders	DSS success	Multi-item Likert scale Survey of 378 managers in 124 firms	Factor analysis Test/retest reliability
	Galletta & Lederer	User information	Semantic differential scale Survey of 65 managers	Test/retest reliability

12.2.3 Domain of SCORE Construct

The first step in the operationalization of a construct is delineation of its domain. Four questions central to Strategic Management Constructs help delineate the conceptual domain of the proposed construct. These are discussed below.

Scope The strategies can be viewed either as means or as goods. The scope of the construct SCORE is the means adopted to achieve the desired goals.

Hierarchical Level BPR strategy concept is categorized at three levels, namely corporate level, business level and functional level.

Corporate level strategy is concerned with top level issues. *Business level strategy* is concerned more with the strategies at the *Strategic Business Unit* (SBU) level. *Functional level strategies* are derived from business level strategy. The construct SCORE used is defined at the business level.

Impact Impact of BPR can be expressed at different levels in a business enterprise. They are:

(i) **Internal:** These impact the efficiency and effectiveness of organizational structures and processes so as to achieve goals and objectives.

(ii) **Competitive:** These affect the ability of the organization to outmaneuvre competition in the industry in which does business.

(iii) **Business Portfolio:** These affect the decision about the industries to compete in, and how to position the organization in these industries.

SCORE is defined at the level of competitive strategy since competitive advantage directly manifests itself at this level.

Dimensionality SCORE is conceptualized as a multimeasure construct. This has three major advantages.

- The specificity of individual measurement items can be leveraged out when they are combined.
- By combining items, it is possible to make fine distinctions between the respondents.
- The reliability of multivariable multimeasure construct tends to be higher, and the measurement error tends to reduce.

It can, therefore, be said that **SCORE** refers to the benefits accruing to a business enterprise in terms of changes in its competitive position that are caused by the BPR programme.

The text on BPR describes the number of benefits that can be gained from a BPR programme when these benefits are grouped together with respect to cost leadership, inter-organizational efficiency, comparative efficiency and productivity.

Table 12.2 gives the hypothesized variables of SCORE and their proposed measures.

Table 12.2 *Hypothesised Variables of SCORE and their Proposed Measures*

Primary activity efficiency	• Cost of activities associated with procuring, warehousing and distributing the inputs required • Cost of transforming inputs into final product • Cost of marketing the final product • Cost of providing services to maintain/enhance product value
Support activity efficiency	• Cost of improving present products • Cost of overall coordination of primary activities • Cost of general management activities • Cost of interacting and coordinating activities with suppliers and customers
Supplier threat	• Ability to locate alternate suppliers • Ability to change to alternate suppliers • Ability to evaluate various suppliers and choose the most appropriate one • Ability to threaten backward integration
Buyer threat	• Ability to locate alternate customers • Ability to change to alternate customers • Ability to evaluate various customers and choose the most appropriate one • Ability to threaten forward integration
System flexibility	• Flexibility in product mix • Flexibility in product volume • Flexibility in product development • Flexibility in new product development • Flexibility in delivery schedules
Exception handling	• Ability to fulfill requests for priority treatment to orders • Ability to handle unacceptable administration information • Ability to handle unacceptable technical and configuration information • Ability to handle unacceptable sourcing information
Comprehensiveness	• Development of thorough analyses to make major business decisions • Ability to analyse technology trends • Ability to analyse business environment issues that influence BPR planning • Ability to analyse and understand existing business processes
Process orientation	• Extent of reduction in checks and control • Degree of concurrency among various jobs and activities • Degree of empowerment in workers for decision making • Degree of multiplicity of versions of business processes

Proactiveness	• Ability to identify new opportunities using BPR related to present operations • Ability to obtain 'first mover' advantages • Ability to create and maintain technological leadership • Ability to obtain unique know how about the market
Congruence	• Extent of alignment of BPR strategies to overall business strategies • Extent of integration of BPR goals and objectives with firm's overall goals and objectives • Extent of top management involvement in BPR project • Extent of interaction between BPR planners and corporate planners
Enabler development	• Degree of IT diffusion and infusion within the company • Extent of IT development • Extent of top management involvement in IT development • Extent of user involvement in IT development
Enabler capability	• Ability in transforming unstructured processes into routinized transactions • Ability to transfer information across large distances with ease and rapidity • Ability to replace/reduce human labour • Ability to capture and disseminate knowledge, information and expertise for management of business processes
Profitability	• Net profit position • Return on investment • Return on sales • Financial liquidity
Growth	• Sales growth • Market share gains • Net income growth • Earnings per share

A discussion on the benefits, that are conceptualized as fourteen variables, are given below:

Efficiency Efficiency is conceptualized as an effect resulting from the organization's efforts towards process innovations leading to a radical reduction in the input-output conversion ratio. It enables the organization to maintain and sustain its overall cost leadership. The individual variables in efficiency are primary activity efficiency and secondary activity efficiency.

Threat Threat refers to the extent of impact on the bargaining power of customers and suppliers and is related to switching and search related costs. Rise in threat increases the dependence of the organization on its primary customers and suppliers to sustain business operations, thereby impacting the bottomline of the organization. The individual variables here are buyer threat and supplier threat.

System Flexibility This variable primarily refers to the firm's ability to respond to uncertainities and unforeseen environmental factors, whether they are based in product markets or manufacturing processes and their inputs.

Exception Handling The second primary impact of a firm's flexibility is in its ability to handle an exception that covers issues like incomplete and erroneous information in inputs and outputs and requests to deviate from standard procedures and situations the business system was never designed to handle.

Proactiveness This variable reflects the proactive behaviour with respect to early and successful pre-emption to market, participation in emerging industries, continuous search for market opportunities and experimentation with potential responses to changing environmental trends. It enables a firm to enjoy advantages in introducing new products and brands ahead of competition, strategically eliminating operations that are in the mature or declining stages of the product life cycle (PLC). It is a measure of the benefits that a firm receives by virtue of its being early to market in all aspects.

Comprehensiveness This refers to the extent of understanding of business situations prior to major decisions, ability to keep track of technology trends, and ability to understand business environment issues that influence BPR and strategic planning.

Process Orientation This variable refers to the extent of understanding of business processes and ability to synchronize business operations.

Congruence Congruence refers to the integration of BPR programme with overall corporate goals, strategies and environment. Top management needs a framework to understand the method to integrate BPR into corporate structure and an action plan to seize the opportunities. A proper integration and synergy between BPR planning and overall corporate planning gives the business a long term competitive advantage.

Enabler Development BPR being a radical change process needs an enabler that would help make the change happen. The enabler facilitates the change process in the organization and measures the extent of involvement of information technology (IT) in the organization's change process. It also measures the extent of IT diffusion and infusion in the organization.

Enabler Capability This variable measures the capability of IT in bringing about radical change in the organization that can contribute in transforming unstructured processes into routinized transactions, transfer information with rapidity and ease across large distances, replace/reduce human labour, and capture and disseminate knowledge.

Profitability This is the first among output variables. It primarily indicates the efficiency of business processes in practice. Thus, profitability indicates whether the implementation of business processes would impact the bottom line of the company. The individual measures in this variable are net profit, return on sales, return on investment and financial liquidity.

Growth Growth is the second output variable that refers to the effectiveness of the business processes in practice. The individual measures in this are sales growth, market share, net income and earnings per share. Good results in these measures indicate, right processes are in place.

12.3 PILOT STUDY

In this section, we discuss how the construct, SCORE, was operationalized in the Indian context. For this purpose, we need to do a *pilot study*, followed by the *main study*. The purpose of the pilot study is to test the research instrument on a relatively smaller sample and infer from the results if the research is on the right track.

12.3.1 Overview

Figure 12.2 gives an overview of the conceptualization and measurements of the proposed SCORE construct of the 14 variables have been listed in Table 12.2, 12 are input variables and 2 are output variables, specifically defined for the construct in question. The content validity of SCORE variables is justified with the competitive advantage model of Porter—low cost, differentiation and sustainability. The SCORE variable *efficiency* taps low cost, *system flexibility and exception handling* capture differentiation, while *proactiveness and comprehensiveness* enable sustainability.

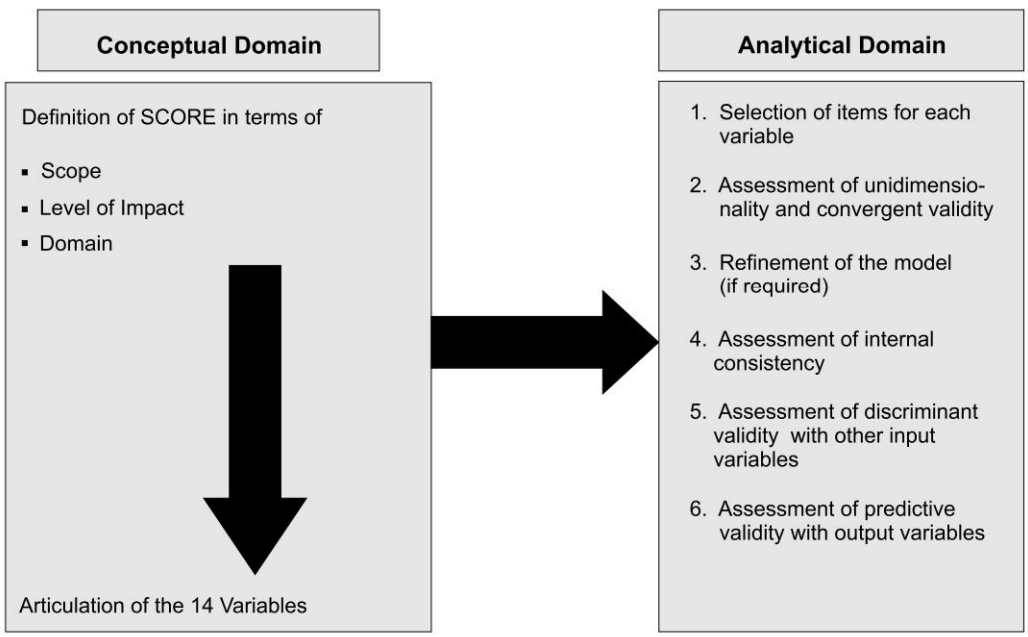


Figure 12.2 *An Overview of Conceptualizing and Measuring Proposed SCORE Construct*

The initial items for the 14 SCORE variables were obtained through an exhaustive review of research literature. It generated 56 items. Each of these items was converted into a question. The preference for perceptual data reflects the choice to operationalize the SCORE construct in terms of managerial perceptions. A structured questionnaire was used to elicit data using personal interview and mail responses. 5 point Likert scale was used, with the ends going either from 'strongly agree' to 'strongly disagree', or from 'greatly increased' to 'greatly decreased'. 30 respondents from nine organizations filled the questionnaire and provided feedback regarding wording of questions, their understandability, and overall organization of the instrument. Apparently, there was no difficulty in understanding the questions, but, according to the respondents, some involved revealing confidential information about the organization.

The statistical descriptive analysis on pilot data is given in Table 12.3. As can be seen, notwithstanding the small sample size, the data exhibits normal distribution. Hence, it is amenable to other statistical analysis.

Table 12.3 *Descriptive Statistical Analyses on Pilot Data*

Maximum possible score	280
Least possible score	56
Mean cumulative score	226.65
Median	226.50
Coefficient of skewness	0.0951
Standard deviation	4.730
Mean + 1 (Standard deviation covers 64% of the scores)	
Mean + 2 (Standard deviation covers 95% of the scores)	

Reliability Reliability refers to the extent of dependability consistency and repeatability, or stability, of a scale. If items of a scale are internally consistent, i.e., they explain majority of variations in the construct as against measurement error, the scale is said to be reliable. Multi-item scale was used to collect primary data for the pilot survey. Co-efficient alpha (Cronbach alpha coefficient) is the most widely used statistic of reliability assessment. The scale is said to be reliable if the alpha value is greater than 0.60 for an exploratory study, with an ex-post-facto design of this nature. Table 12.4 gives coefficient alpha for each of the 14 SCORE variables.

As can be seen, 11 of the 14 variables of the SCORE construct have coefficient alpha values above 0.60. Of the remaining three, two, i.e., enabler capability and supplier threat, are just a shade below, and hence are acceptable. Process orientation has an alpha value of 0.54. For an area that is nascent, like BPR, and for an exploratory study of this nature, this coefficient alpha value is acceptable, considering that it is a pilot study with a sample size of just 30 respondents.

Table 12.4 *Coefficient Alpha Values for Reliability Assessment of the SCORE Construct*

Variable	*Items*	*Coefficient Alpha*
Primary Activity Efficiency	4	0.65
Secondary Activity Efficiency	4	0.68
Supplier Threat	4	0.59
Buyer Threat	4	0.71
System Flexibility	4	0.67
Exception Handling	4	0.64
Comprehensiveness	4	0.73
Process Orientation	4	0.54
Proactiveness	4	0.61
Congruence	4	0.65
Enabler Development	4	0.67
Enabler Capability	4	0.59
Profitability	4	0.74
Growth	4	0.72

12.3.2 Factor Analysis

A confirmatory factor analysis was performed on the pilot data. It yielded 6 statistically distinct factors explaining 72.2% of the variance, and the output converged in 15 iterations on a varimax rotation. (Refer to Table 12.5.) Since the sample size was small, only 30 respondents, the 6 factors were not labeled (factors with such a small data are seldom reliable and cannot be used for further analysis). Eigen value refers to factors loading for each of the factors. It is considered significant where the value exceeds 1.

Table 12.5 *Confirmatory Factor Analysis Results on Pilot Data*

Factor	*Eigen Value*	*Variance (%)*	*Cumulative Variance (%)*
ONE	2.548	18.2	18.2
TWO	1.819	13.2	31.4
THREE	1.773	12.8	44.2
FOUR	1.409	10.2	54.4
FIVE	1.172	8.4	62.8
SIX	1.029	7.4	72.2

Table 12.6 gives the correlations between each of the 14 SCORE variables. As can be seen, all the 14 variables have correlation coefficients of less than the 0.50. This indicates that there is no significant overlap.

Table 12.6 *Inter-item Correlation between SCORE Variables*

Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
1. Primary Activity Efficiency	1.0													
2. Support Activity Efficiency	0.39	1.0												
3. Supplier Threat	0.34	0.38	1.0											
4. Buyer Threat	0.29	0.36	0.36	1.0										
5. System Flexibility	0.12	0.27	0.36	0.34	1.0									
6. Exception Handling	0.17	0.21	0.24	0.28	0.30	1.0								
7. Comprehensiveness	0.13	0.36	0.22	0.33	0.31	0.21	1.0							
8. Process Orientation	0.24	0.26	0.28	0.31	0.35	0.39	0.37	1.0						
9. Proactiveness	0.09	0.10	0.11	0.13	0.14	0.16	0.27	0.28	1.0					
10. Congruence	0.22	0.35	0.33	0.12	0.33	0.23	0.34	0.25	0.27	1.0				
11. Enabler Development	0.23	0.21	0.22	0.23	0.34	0.25	0.12	0.11	0.17	0.19	1.0			
12. Enabler Capabilities	0.32	0.44	0.34	0.28	0.13	0.34	0.16	0.18	0.17	0.18	0.32	1.0		
13. Profitability	0.11	0.34	0.40	0.27	0.23	0.35	0.40	0.37	0.32	0.19	0.20	0.24	1.0	
14. Growth	0.28	0.26	0.29	0.31	0.39	0.14	0.34	0.36	0.38	0.40	0.42	0.33	0.32	1.0

12.3.3 Refining the Measure

The findings of primary analysis can be summarized as follows.

From Table 12.6, it is clear that the data has normal distribution, is reliable, data method is acceptable and, also, all the variables are mutually exclusive and collectively exhaustive. Hence, the methodology can be proceeded with in the final study. This is given in the next chapter.

12.3.4 Summary

The SCORE construct initially had 14 variables. These variables were pre-tested using a structured questionnaire with sample size of 30 respondents. The major findings indicated that the data had a normal distribution, was reliable, data collection method was acceptable and all the variables were mutually exclusive and collectively exhaustive.

12.4 MAIN STUDY

In the main study, a larger sample is used to collect primary data. The instrument used is the structured questionnaire, developed and refined during pilot study. After collecting the new data and assessing its structured validity, research findings are also examined.

12.4.1 Characteristics of the sample

72 organizations, that had embarked on BPR programme, were drawn for the purpose of the study. Most of them were in large cities in the country, with a few sprinkled in small sectors. The primary data was collected by personally administering the questionnaire in the organizations. One hundred and eighty one responses were collected from 72 organizations. The sample characteristics are given in Table 12.7.

Assessment of Multivariate Normality The data has to satisfy multivariate normality for further analysis. *Multivariate normality* is a generalization of univariate normal density for more than two variables. A *univariate normal distribution*, with mean (μ) and variance (σ^2), has a probability density function.

$$f(x) = \{1/(2\pi\ \sigma^2)^{1/2}\}\ e^{-[(x-\mu)\ /\sigma]2/2} \quad \text{(i)}$$

A plot of this function yields a bell-shaped curve. For a normal random variable X,

$$P\ (\mu - \sigma <= X <= \mu + \sigma\ ) \sim 0.683 \quad \text{(ii)}$$

$$P\ (\mu - 2\sigma <= X <= \mu + 2\sigma) \sim 0.954 \quad \text{(iii)}$$

Table 12.7 *Characteristics of the Sample for Final Study (N=181)*

Title/Level of the Informant	Head of the Unit (Vice President, Chief Information Officer, Chief Technology Officer)	64%
	Second Level Managers (Strategic planners, Business planners, IT/EDP managers)	36%
Range of Sales of the Responding Organization	Less than Rs. 500 million	19%
	Between Rs. 501 – 1000 million	27%
	Between Rs. 1001 – 2000 million	10%
	Between Rs. 2001 – 5000 million	25%
	Above Rs. 5000 million	19%
Business Category	Manufacturing sector	71%
	Services sector	29%
Characteristics of the BPR Programme	Primary users of the application	
	• Customers	19%
	• Company personnel	81%
	• Average length of time (in months) the programme has been in use	22%
Enabling Technology utilized (some have used multiple technologies)	Application software	33%
	Expert systems, DSS and EIS	19%
	Database management systems	14%
	Networking technology	29%
	Others	18%

The multivariate normal density is obtained by replacing univariate parameters with multivariate generalized parameters. Hence, for a distribution with p variables, the probability distribution function would be,

$$f(x) = \{1/(2\pi)^{p/2}|\Sigma|^{1/2}\}\ e^{-(x-\mu)\sigma-1(x-\mu)/2} \qquad \text{(iv)}$$

where, $-a < x_i < a$, $i = 1, 2, 3, \ldots p$

All the statistical techniques used in the subsequent section are based on the assumption that the data satisfy the condition of multivariate normality. Two methods were utilized:

(i) Descriptive statistics
(ii) Q-Q Plot of distribution

12.4.2 Descriptive Statistics

The data are subjected to descriptive statistical analysis. This broadly consists of measures of central tendency and measures of dispersion. *Central tendency* refers to

the location of the centre of distribution. It tells us where the data are, or what a typical observation is. *Dispersion* reveals the degree of variation of individual values around a central point. It is the tendency of individual values to deviate from the measure of central tendency towards small and large values of the variables. *Skewness* is the lack of symmetry on both sides of the peak of a distribution. Table 12.8 summarizes the findings.

Table 12.8 *Descriptive Statistical Analysis on Main Data*

Maximum possible score	280
Least possible score	56
Mean cumulative score	226.65
Median	226.50
Coefficient of skewness	0.0951
Mode	224
Range	20
Variance	22.39
Standard deviation	4.730
Mean + 1(Standard deviation covers 64% of the scores)	
Mean + 2(Standard deviation covers 95% of the scores)	

As can be seen, the pilot data fulfills the requirements of normal distribution with very little skewness, which is negligible.

12.4.3 Q-Q Plot of Distribution

Q-Q plots are used as the second technique to assess the data and their performance for marginal distribution of sample observations on each variable. When the points lie very nearly along straight lines, the assumption of normality holds. The pattern of deviations also provides clues about the nature of non-normality.

For a standard normal distribution, the quantiles q are defined as:

$$P\,[Z<=q\ (j)] = \left[j - \frac{1}{2}\right] \Big/ n \qquad \text{(v)}$$

where $p(j)$ is the probability of getting a value less than or equal to $q(j)$ in a single drawing from standard normal population. The idea is to look at pairs of quantiles $[q(j), x(j)]$ with the same associated cumulative probability as in equation (v). As seen in Fig. 12.3, the points lie very nearly on a straight line, thus indicating that the distribution satisfies the condition of normality. Here, the X-axis depicts the

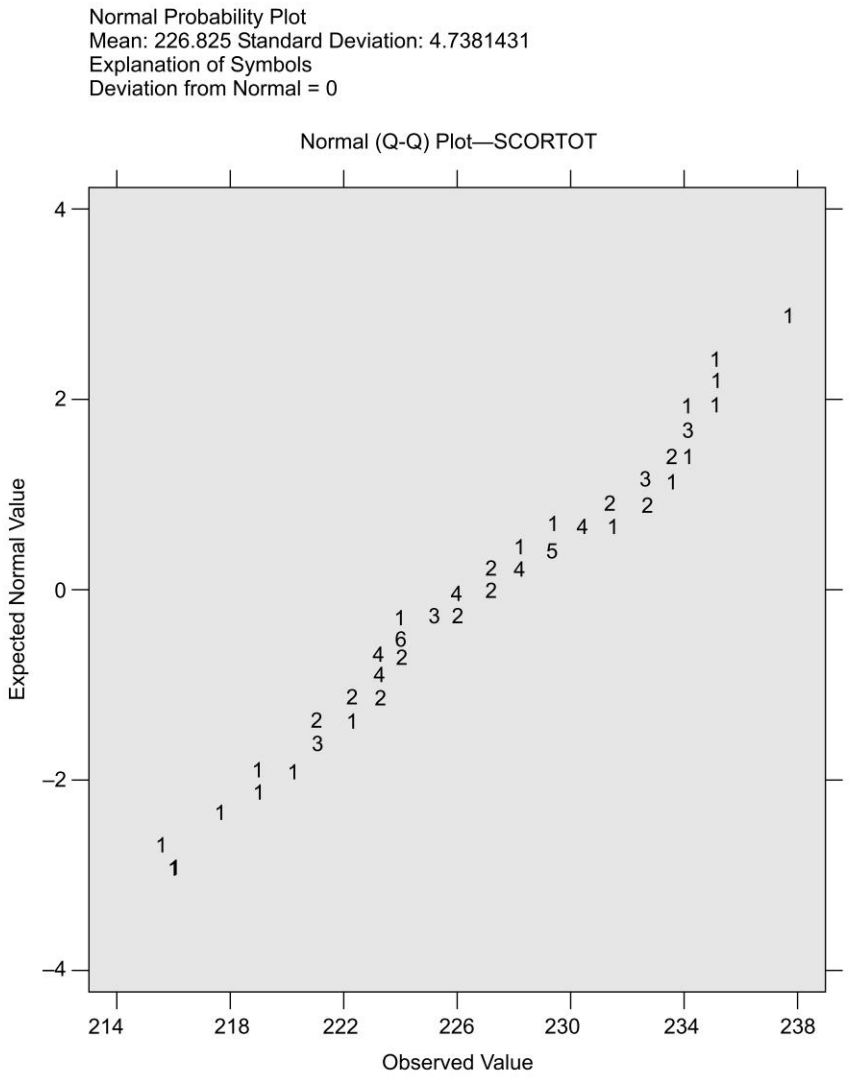


Figure 12.3 *Normal (Q–Q) Plot*

ordered observations, i.e., $x(j)$, and Y-axis depicts the standard normal quantiles, i.e., $q(j)$.

The straightness of the Q-Q plot was measured calculating the correlation coefficient of the points in the plot, expressed as:

$$R_q = [\Sigma(x(j) - x)(q(j) - q)] / [\Sigma(x(j) - x)^2]^{½} [\Sigma(q(j) - q)^2]^{½} \quad \text{(vi)}$$

The correlation coefficient (R_q) was calculated to be 0.985. This clearly shows that the distribution has a statistically acceptable level of normality. For a sample size

of above 150, distribution can be said to be normal if the correlation coefficient exceeds 0.95. Figure 12.3 gives the Q-Q plot for the data.

12.4.4 Analysis of Variance (ANOVA)

The samples include respondents from the business enterprise, the manufacturer and the services sector. They also include large and small businesses. To ensure that the respondent sample was not biased towards a specific type of firms, based on location, size and industry, a one way ANOVA was performed on the complete data set. Table 12.9 summarizes the findings.

Table 12.9 *Results of ANOVA within Sample*

	Type of ANOVA	*Between Column Variance*	*Within Column Variance*	*F Value*
1.	Between 129 respondents from manufacturing sector and 52 respondents from services sector	146.10	143.94	1.01
2.	Between organizations of various sizes based on their sales revenue	14.22	140.01	0.10

As can be seen, there are no significant differences in response from enterprises with difference in business category and sizes. This enhances the generalization of the results to a larger population.

12.4.5 Assessment of Measurement Properties

The main study data was subjected to multiple statistical analytical methods to assess its measurement properties. First SCORE was tested for reliability using coefficient alpha (α). To identify the underlying factors within the SCORE construct, the main data were supplied to a confirmatory factor analysis. Final SCORE was assessed for construct validity, that included content validity, convergent validity, discriminant validity and predictive validity. SPSS package was used for all analysis.

12.4.6 Reliability

There are three basic methods for assessing reliability of a measurement scale or a construct.

- Test-retest reliability
- Internal consistency reliability
- Alternative forms reliability

All three methods attempt to determine the proportion of variance in a measurement scale that is systematic. However, the difference arises when the scale is to be correlated with two computed reliability coefficient alpha. In *test-retest reliability*, an identical set of items is compiled on the same subject at different times and then correlated. In *internal consistency reliability*, the measurement scale is administered to subjects at one point in time. Subsets within the scale are correlated. In *alternative forms reliability* two similar sets of items are applied to the same subject at different times, in alternative forms. Items in one form are designed to be similar, but not identical, to items in the other form. The result scores are then correlated. According to experts, internal consistency reliability method can be a suitable approach for the present research study. We will use the internal consistency reliability method here.

12.4.7 Internal Consistency Reliability

Coefficient alpha is the most important measure of reliability for internal consistency. Split half method, a basic form of the items, is used in the present case. Scores are split into half and the result scores are then correlated. However, different results can be obtained even in split half method depending on how the items are split in half. To overcome this, Cronbach alpha coefficient is the most commonly used formula for assessing the reliability of a measurement scale with multipoint items. Alpha coefficient is the square root of the estimated correlation of the measure with errorless true scores. This is formulated as,

$$\alpha c = \left\{ \left[k/(k-1) \right] \left[1 - \left(\sum_{i=1}^{k} \sigma \mathrm{i}^2 \right) \Big/ (\sigma i^2) \right] \right\} \qquad \text{(vii)}$$

Typically, the scale is said to be reliable if the alpha value is greater than 0.60 for an exploratory study of this nature. Table 12.10 gives coefficient alpha for each of the 14 SCORE variables.

As can be seen, the overall coefficient alpha is 0.715 and all the alpha values are above 0.60, which shows that the results are reliable.

12.4.8 Assessment of Construct Validity

Construct validity is based on five major individual attributes. They are:

- Content validity
- Unidimensionality
- Convergent validity
- Discriminant validity
- Predictive validity

Table 12.10 *Coefficient Alpha Values for Reliability Assessment of the SCORE Construct*

Variables	*Items*	*Coefficient Alpha*
Primary activity efficiency	4	0.68
Secondary activity efficiency	4	0.69
Supplier threat	4	0.69
Buyer threat	4	0.78
System flexibility	4	0.77
Exception handling	4	0.74
Comprehensiveness	4	0.70
Process orientation	4	0.66
Proactiveness	4	0.71
Congruence	4	0.66
Enabler development	4	0.69
Enabler capability	4	0.63
Profitability	4	0.71
Growth	4	0.75
Overall coefficient alpha		0.715

If a construct satisfies these five properties then it can be inferred that it is valid.

Content Validity SCORE was tested for each of the above measurement properties. If the items of a construct are extracted after a comprehensive literature survey, it can assumed to be content valid. SCORE meets this requirement.

Unidimensionality *Unidimensionality* refers to the individual items measuring only SCORE and nothing else. In the absence of unidimensionality scale, number cannot be used to represent the value of a scale. *Convergent validity*, on the other hand, is the extent to which varying approaches to construct measurements yield the same results. At one extreme, completely different methods of administering the instruments can be used to determine convergent validity. At the other end, each item in the scale can be viewed as a different approach to measuring the construct. Usually for practical purposes, researchers prefer the latter approach, as was done in this study also. It checks the convergent validity using the Bentler-Bonett coefficient (Bentler-Bonett 1980), also called the *Bentler Bonett Index* (BBI).

BBI is given by the following equation

$$\text{BBI} = \{[(\chi 2_0/df_0) - (\chi 2/df_m)]/[(\chi 2_0/df_0) - 1\} \quad \text{(viii)}$$

BBI is not affected by sample sizes. However, the values tend to be large as the fit is compared to a base line model. BBI values of 0.90 or above demonstrates strong convergent validity. Table 12.11 summarizes the assessment of unidimensionality and convergent validity for the SCORE construct.

Table 12.11 *Assessment of Unidimensionality and Convergent Validity*

Variable	*Number of Indicator*	*Chi Square*	*DF*	*Bentler Bonnet Index*
Primary activity efficiency	4	0.45	3	0.98
Support activity efficiency	4	12.43	3	0.97
Supplier threat	4	6.54	3	0.92
Buyer threat	4	7.37	3	0.89
System flexibility	4	2.74	3	0.90
Exception handling	4	10.96	3	0.97
Comprehensiveness	4	9.04	3	0.96
Process orientation	4	3.89	3	0.92
Proactiveness	4	8.57	3	0.95
Congruence	4	7.62	3	0.94
Enabler Development	4	0.90	3	0.98
Enabler capability	4	1.25	3	0.90
Profitability	4	2.34	3	0.91
Growth	4	1.35	3	0.93

As can be seen, with the exception of buyer threat, all other variables show a BBI value of more than 0.90, indicating strong convergent validity. The value in the case of buyer threat is also close to 0.90, and so does not warrant any refinements.

Convergent Validity It is extent to which varying approaches to construct approaches yield the same result. (Campbell & Fiske, 1959)

Discriminant Validity This refers to the degree to which measurements of the SCORE variables are unique. The construct expects discriminant validity if its items estimate only one construct. Discriminant validity for SCORE was assessed by testing if correlation between buyers of variables was significantly different from unidimensionality. The results are presented in Table 12.12.

Table 12.12 *Assessment of Discriminant Validity*

Variables	*Chi square Statistics*		*Chi square Difference*
	Constrained Model	*Unconstrained Model*	
Primary Activity Efficiency with			
Support activity efficiency	122.98	38.06	84.92
Supplier threat	77.85	34.25	43.60
Buyer threat	122.85	29.75	92.61

(Contd.)

Variables	*Chi square Statistics*		*Chi square Difference*
	Constrained Model	*Unconstrained Model*	
System flexibility	87.90	43.98	43.98
Exception handling	60.14	14.78	45.36
Comprehensiveness	90.53	83.96	6.57
Process orientation	60.14	59.72	0.42
Proactiveness	153.92	106.23	47.69
Congruence	79.26	61.16	18.10
Enabler development	54.06	49.19	4.87
Enabler capability	183.92	78.88	105.04
Profitability	137.15	81.13	56.02
Growth	122.14	68.95	53.19
Support Activity Efficiency with			
Supplier threat	122.12	65.90	56.22
Buyer threat	90.45	56.39	34.06
System flexibility	45.87	23.67	22.20
Exception handling	120.23	53.32	66.91
Comprehensiveness	34.19	12.43	21.76
Process orientation	89.53	54.68	34.85
Proactiveness	40.06	19.99	20.07
Congruence	67.49	23.84	43.65
Enabler development	56.30	22.20	34.10
Enabler capability	100.35	40.43	59.92
Profitability	120.33	49.09	71.24
Growth	92.01	42.10	49.91
Supplier Threat with			
Buyer threat	123.78	67.56	56.22
System flexibility	92.68	19.02	73.66
Exception handling	34.72	12.65	22.07
Comprehensiveness	56.39	13.35	43.04
Process orientation	72.33	34.45	37.88
Proactiveness	45.55	28.37	17.18
Congruence	48.30	23.01	25.29
Enabler development	64.47	29.44	35.03
Enabler capability	110.32	73.22	37.10
Profitability	99.22	45.24	53.98
Growth	101.64	66.23	35.41

(Contd.)

Variables	Chi square Statistics		Chi square Difference
	Constrained Model	Unconstrained Model	
Buyer Threat with			
System flexibility	88.31	46.90	41.41
Exception handling	45.03	27.11	17.92
Comprehensiveness	120.12	45.92	74.20
Process orientation	23.99	20.90	3.09
Proactiveness	111.20	89.02	22.18
Congruence	102.34	45.53	56.81
Enabler development	139.42	99.22	40.2
Enabler capability	74.33	66.43	7.9
Profitability	35.30	12.22	23.08
Growth	90.36	47.21	43.15
System Flexibility with			
Exception handling	111.02	79.02	32.00
Comprehensiveness	100.34	55.53	44.81
Process orientation	129.42	89.24	40.18
Proactiveness	70.33	63.44	6.89
Congruence	55.33	22.42	32.88
Enabler development	70.36	37.21	33.15
Enabler capability	45.57	38.97	6.60
Profitability	48.33	28.01	21.32
Growth	64.44	29.24	35.20
Exception Handling with			
Comprehensiveness	65.76	24.45	41.31
Process orientation	48.35	29.39	18.96
Proactiveness	40.30	23.10	17.2
Congruence	67.47	29.48	37.99
Enabler development	75.57	45.87	29.70
Enabler capability	76.87	43.54	33.33
Profitability	77.45	32.45	45.00
Growth	90.43	43.43	47.00
Comprehensiveness with			
Process orientation	123.78	67.56	56.22
Proactiveness	92.68	19.02	73.66

(Contd.)

Variables	*Chi square Statistics*		*Chi square Difference*
	Constrained Model	*Unconstrained Model*	
Congruence	34.72	12.65	22.07
Enabler development	56.39	13.35	43.04
Enabler capability	72.33	34.45	37.88
Profitability	87.64	35.67	51.97
Growth	53.47	42.56	10.91
Process Orientation with			
Proactiveness	89.65	45.67	43.98
Congruence	76.86	44.31	32.55
Enabler development	77.98	43.20	34.78
Enabler capability	87.42	64.65	22.77
Profitability	32.68	12.43	20.25
Growth	102.46	67.78	34.68
Proactiveness with			
Congruence	89.48	54.53	34.95
Enabler development	45.98	33.55	12.43
Enabler capability	65.90	21.87	44.03
Profitability	76.92	32.34	44.58
Growth	109.53	78.65	30.88
Congruence with			
Enabler development	65.36	24.39	40.97
Enabler capability	73.55	12.45	61.10
Profitability	42.10	24.31	17.79
Growth	86.76	42.76	44.00
Enabler Development with			
Enabler capability	68.67	24.77	43.90
Profitability	97.99	45.11	52.90
Growth	87.66	56.63	31.03
Enabler Capability with			
Profitability	79.87	43.53	36.36
Growth	45.64	12.13	33.51
Profitability with			
Growth	65.77	44.43	21.34

As can be seen, all the buyer wise results indicate strong support for discriminant validity criterion. Hence, the conceptual domains do not have any significant overlap within the distinctive characteristic of the SCORE variables.

Predictive validity This seeks to validate if the measures of use in a construct behave in accordance with the theory. Predictive validity of scores is assessed by examining between each SCORE variable and two important variables of business performance growth and profitability. The structural equivalent is written as

$$\eta = \Gamma\ \xi + \xi \qquad \text{(ix)}$$

where η is the endogenous theoretical construct, Γ is the matrix of structural coefficients relating the exogenous theoretical construct to η and ξ is the residual of η.

Predictive validity admits to invest where measures produce results that are consistent with a prioritized exception, or the degree to which predictions from a theory network are confirmed by empirical data. Table 12.13 gives the results of 24 decisions carried out to relate each of the 12 SCORE input variables to the two output variables, growth and profitability.

Table 12.13 *Assessment of Predictive Validity*

SCORE Input Variables	*Score Output (Performance) Variables*			
	γ	*Profitability* ***t*-value**	γ	*Growth* ***t*-value**
Primary activity efficiency	0.421	4.546	0.524	4.103
Support activity efficiency	–0.124	–1.451	0.139	0.927
Supplier threat	–0.138	–1.783	–0.127	–1.002
Buyer threat	–0.127	–1.385	–0.098	–0.946
System flexibility	0.249	2.237	0.387	3.928
Exception handling	–0.116	–1.346	0.394	4.654
Comprehensiveness	0.233	3.894	0.159	1.985
Process orientation	0.335	3.129	0.417	4.236
Proactiveness	0.376	4.634	0.320	3.995
Congruence	0.298	2.591	0.224	2.194
Enabler development	–0.195	–1.837	0.397	3.538
Enabler capability	0.129	1.787	0.435	4.129

Note $p < 0.01$

12.4.9 Summary

A structured questionnaire was used to collect primary data for performance of the main study. To facilitate deeper response, it was segmented into six sections.

Data was collected using a structured questionnaire and personal interview. The characteristics of the sample are as summarized in Table 12.7. The constitution of the sample justifies randomness and representativeness.

The sample was tested for multivariate normality, an extremely important condition to be fulfilled before the data can be run any further through multivariate statistical analysis. To ensure that the sample was not biased towards specific types of firms based on location, size and industry, a one-way ANOVA table was performed on the complete data set. Hence, it enhances the generality of the results.

The SCORE was tested for reliability using coefficient alpha to identify the common underlying factors within the score construct. The main data was subjected to a confirmatory factor analysis. SCORE was also assessed for its construct validity, that includes content validity, discriminant validity and predictive validity.

12.5 RESEARCH FINDINGS

The SCORE construct was subject to test for all major and important measurement properties as seen earlier in the chapter. It was found to be valid and related, and fulfilled the condition of unidimensionality. As mentioned, the main study data was collected from 181 respondents in 72 organizations. The number of respondents in the manufacturing section was higher since it has been at the forefront in implementing BPR and also quality improvement programmes.

12.5.1 Interpretive Factors

The research study brought forth factors of sustainable competitive advantage due to BPR at the SBU level. These factors were second level variables/parameters that were distilled from a predefined set of 14 variables, of which 12 were input variables and two were output variables. The study of 56 indicators/measures that validly operationalize the 14 variables was developed. The measures were extracted after an extensive literature survey and interaction with experts. These factors are:

- Internal process efficiency
- Threat
- Corporate agility
- Strategic alignment
- Enabler role
- Business performance

Internal process efficiency addresses, the question 'Whether the business enterprise is doing the things right and efficiently?' From the sample, it turned out to be a

crucial parameter in capturing the fact that organizations not only strive to improve their effectiveness but also give equal importance to efficiently performing their internal activities and processes. Organizations, in general, can face *threat* from suppliers and customers. The second factor represents the threat perspective, with organizations implementing BPR in the hope to reduce this perspective and seize more control by way of forward stroke or backward integration, and also by having multiple agencies to deal with.

Organizations agreed that they needed to respond to changing business environment quickly and efficiently. This parameter is represented by *corporate agility*. It requires organizations to introduce new offerings at lower costs. Time to market was also an important issue. Organizations felt that a BPR programme, centrally, administered was instrumental in aligning individual business units with overall corporate goals. This parameter was captured by *strategic alignment*. According to organizations *Enabling technology* played a crucial role in securing maximum benefits out of the BPR initiative. Most of the organizations, from the sample used, voted IT as a primary enabler for BPR. Organizations were found to be using commercially available applications like Lotus Notes, Lotus Domino, Relational Database Management Systems (RDBMS), decision support systems and executive information systems. Larger organizations were, in addition, using ERT packages like SAP, BAAN, Oracle, etc. In other words, IT was the favoured choice among organizations. Finally, all BPR managers needed to address the issue of *business performance*. BPR initiative, on an average, lasted about two years, making it highly resource intensive. Naturally, business enterprises were concerned about the benefits that they could leverage out of such an effort. It narrowed down to the question of 'Return of Investment (ROI)' for a BPR programme. ROI could not be measured successfully since there were many qualitative benefits that accrued due to BPR effort. It was almost impossible to come to a numerical value for them. However, many large organizations were using some kind of business performance management system to capture the benefits in an easily understandable method.

12.5.2 Relationship Among Input Values

As discussed earlier in the chapter, factors were extracted from 14 variables. Each factor was a combination of multiple values. Hence, each individual factor captured and reflected some common underlying dimensions. This is possible if the constitution variables of a factor have some relationship or dependency among themselves, such that they, together, are able to represent a common underlying dimension for the factor. However, it does not mean that the variables measure the same business issue as a new case. This would result in great overlap that would mean existence of redundancy among them. The tables discussed earlier in the chapter show that

there was no statistically significant overlap among the input variables. Also, the data fulfilled the requirements of convergent and discriminant validity.

This is the extent to which a BPR programme allows a firm to manufacture outputs, while maintaining its overall cost leadership. It was seen that primarily and support activity efficiency variables significantly related to all variables except comprehensiveness, process orientation, congruence and enabler capacity. This is largely consistent with the expectations as these four variables focus more on effectiveness of the programme rather than efficiency. This refers to the extent of impact on the bargaining power of customers and suppliers, pertaining to switch and search related costs. *Increase in dependence of the business enterprise on its primary customers and suppliers, to assist operations, increases the threat perception.*

12.5.3 Relationship Between Input and Output Variables

The SCORE construct, under discussion, included 12 input variables and 2 output variables of financial performance, growth and profitability. Profitability captures the benefits that are accrued to the organization in the near future, whereas growth reflects the benefits of the organization where leverage in a longer term scenario. Interesting and significant results came out the study of the relationship among input and output variables. Coefficients were in the expected directions. Theoretically, importance in primary activity efficiency is predicted to have a good positive impact on both profitability and growth of the business enterprise, which clearly comes out in the result. It was found that importance in secondary activity efficiency did not have any positive impact either on profitability or growth. The exception can be that these are only support activities and not core business activities of the organization. The third interesting result is that as the threat (both buyer and supplier threat) increases for an organization, it has a direct negative impact on profitability and growth. These statistical findings are in line with the theoretical framework.

It is jointly accepted that an organization with high flexibility and exception handling would perform better in a buyers market since it would be able to meet customer requirements faster than competition. As can be seen from the results, flexibility has a direct positive impact on both profitability and growth. Exception handling, however, has a positive impact on long term growth, but a negative impact on profitability. This may be due to the fact that when an organization strives to meet exceptions, it may do so at higher cost, since fulfilling exceptions may mean that business plant comes to a temporary phase, affecting the rate of market change. This results in negative impact on short-term profitability. Enabler development also seems to have a negative impact on short-term profitability. This can be explained by the fact that most organizations use technolgy as an enabler in BPR programmes, and, technology being resource intensive, may negatively impact profitability.

Overall, it can be seen that the results provide adequate support for construct validity of the measures developed for SCORE. This means that the operational measures behave as would be expected, given a theoretical perspective. However, it should be understood that these are the first steps in developing 'employee validated measures' in testing value relationships. Construct development is an ongoing activity in measurements based research process. It is crucial that systematic extensions and refinements are made continuously.

Summary

This chapter briefly discusses the importance of construct measurements in the context of BPR. It also highlights the research work done towards the SCORE construct. A case discusses BPR and ensuring competitive advantage by its implementation.

A pilot study and a main study are discussed in detail. With respect to the case study, important topics like Q-Q Plot of the distribution, Analysis of variance, factor analysis etc are discussed in detail. The chapter provides the competitive advantage provided by the BPR.

Review Questions

1. What are the approaches for developing a construct? Discuss.
2. What is SCORE?
3. List the steps followed to develop the measures of the construct SCORE.
4. How does SCORE benefits a business enterprise?
5. What are the 14 SCORE variables identified for the pilot study?
6. What can be a good measure of reliability? What do the results of the pilot study indicate with regard to reliability?
7. What is meant by interitem correlation? Are the SCORE variables interitem correlated?
8. How will you differentiate between the methods of assessing reliability of a measurement scale or a construct? Which method is considered the most accurate? Explain.
9. What do you mean by convergent validity, discriminant validity and predictive validity? Develop an individual framework for assessing the three concepts.

10. 'The multivariate normality is a generalization of univariate normal density for more than two variables'. Justify the statement.
11. List and explain the findings of this case study.

Suggested Readings

Saha P., 'Developing Measures to Assess the Extent of Sustainable Competitive Advantage Provided by Business Process Reengineering', PhD Thesis (Unpublished), IISc, 2000.

Rumelt, Richard P. , *Theory of Business*, Harvard University, September 1994.

Rumelt, Richard P. *Strategy, Structure, and Economic Performance*, Harvard University Press, Boston, 1974.

Rumelt, Richard P., Schendel, Dan, and Teece, David (Eds.), *Fundamental Research Issues in Strategy and Economics*, 12 [A Special Issue of the Strategic Management Journal], 1991.

Rumelt, Richard P., Schendel, Dan, and Teece, David (Eds.), *Fundamental Issues in Strategy*, Harvard Business School Press, Boston, 1994.

Campbell, D.T. and Fiske, D.W., *Psychological Bulletin*, 56(2), pp. 81–205, 1959.

13

CASES OF SUCCESSFUL BPR IMPLEMENTATION

Learning Objectives

This chapter will help the reader in

- Understanding the various approaches for BPR implementation
- Getting an idea of the systematic methodology adopted by organizations
- Comparing BPR implementation in different organizations
- Learning from the results of BPR implementation in organizations

13.1 INTRODUCTION

In this chapter, we discuss different case studies on BPR implementation. The cases have been selected in such a way that they cover manufacturing and service sectors, in both Indian and multinational organizations. This will help to gain an insight into the experience of BPR implementation in different organizations. The cases discuss the following organizations:

1. A large oil refinery in India
2. A US-based multinational industrial supplies manufacturer
3. A UK-based firm from the banking sector

13.2 A LARGE OIL REFINERY IN INDIA

The case study being presented here is of one of the largest oil refineries in India (Sunil Thawani, 1999). The organization had the history of carrying huge inventories, right from project stage. Over a period of time, due to wide variety of vendors, lack of standardization and planning and non disposal of unwanted stores, an inventory of Rs 490 million (US$ 13.6 million) was being 'maintained/managed'. Managing the stores had become a major issue. To find one item, one had to remove ten items. Nobody was accountable for inventory build up. Mismatch of computer stocks and physical stocks resulted in increased downtime, thereby leading to loss of production. Management wanted to radically reduce the inventory.

13.2.1 Planning

Various aspects of planning in the oil refinery are discussed below.

Selecting the Process Inventory, *per se*, cannot be reduced, since it is the result (effect) of various cause factors. To reduce inventory, the organization looked at the processes responsible for its build up. Hence, the process selected for improvement was *Procurement*.

Selecting the Improvement Techniques Considering it was a chronic problem, minor improvements would not have delivered the results expected by the management. In order to achieve breakthrough results, the management selected *Process Reengineering technique*. The methodology applied was *Westinghouse Technology for Improvement of Processes* (WesTIP).

In the five day workshop, the participants:

- Planned for the process to be reengineered
- Analysed the current process

- Reengineered (Redesigned) the process
- Developed implementation plans

Scoping the process In order to ensure that improvement effort remained focused, the procurement process was scoped. While scoping, care is taken that the process is neither too long nor too short. If it is too long, it may remains shallow while mapping and analysis and some critical issues may be left unaddressed. On the other hand, if it is too short, improvement attempted may not impact the business considerably. In the present case, scope of the procurement process was as under:

Process begins with:	Plan (Perceive) requirement
Process includes:	Prepare indent Raise enquiry Evaluate offers Place orders Receive material Inspect material
Process ends with:	Stock charge

Team Formation After scoping the process, a cross functional team was formed to ensure that the participants were knowledgeable about the current process. This required that a 'supplier' and a 'customer' (internal) were part of the team. Some of the members were from a totally different function to bring in objectivity. Team members needed to be creative, bold and willing to take risks, and question the fundamentals.

Usually, a team consists of 6–10 members from middle management and team leader from senior management, with executive director as the sponsor.

Sponsor's Expectations To set stretch targets, sponsor's expectations were defined and documented. These were:

- Improvement in working capital
- Improvement in profitability and productivity
- Space in stores
- Material planning
- Simplification of process
- Reduction in inventory
- Internal and external lead times

13.2.2 Analysis of the Current Process

The current process was analysed with respect to:

- Process cycle time
- Process cost
- Value delivered to customers

Key Issues *Issues* are problems that hinder effective performance of processes. The team members posted issues under each task and then, using '*Dot Voting*' technique, selected key issues.

Some of the key issues affecting process cycle time, cost and value delivered were:

- Poor requirement planning (mostly over indenting and/or stockouts)
- Excessive bureaucracy
- No compliance to order terms by vendors
- Discrepancy in physical and computer stocks
- Limited computerization
- Incomplete indents
- Vendors offers received by fax not accepted
- Incomplete and incorrect invoices
- Poor storage facilities
- Material indented and purchased but not used for years

Internal Customer Value Assessment (Customer Satisfaction Index) To determine the value delivered by the process, value analysis for few internal customers was done.

Paradigms *Paradigms* are the boundaries of beliefs of team members within which, according to them, the organization operates. As a result of these paradigms, improved working methods appear to be impossible. For breakthrough improvements, it is critical to identify and shift existing paradigms.

Some of the existing paradigms identified were:

- Too many signatures would ensure control
- Be safe—involve all
- Servants of system/rules (rules cannot be changed)
- Lowest bid is the best and safest
- Inventory management is material management department's responsibility

13.2.3 Designing the New Process

Stretch Targets In order to achieve a quantum improvement in the reengineered process in line with sponsor's expectations, certain targets with respect to quality, cost and delivery were set that were difficult and challenging to achieve.

The targets were:

- Reduction in elapse time from 306 days to 90 days
- Reduction in cost of indenting and procurement by 50%
- Standardization of items (variety reduction) 10% every year.

Good Ideas After an extensive brain storming session, and also during the course of the workshop, good ideas generated by the team were 'parked'. These were then evaluated and used for designing the reengineered process.

Some of the radical good ideas generated by the team were:

- Procure only what is needed
- Value engineering and standardization
- Integrated computerization (indentors, purchase, stores, finance)
- Payment against document/delivery of material
- System to write off obsolete and surplus items
- Rationalize vendor base

Reengineered Process Based on the outputs available from analysis of the current process, good ideas, key issues, etc., the team designed and mapped the reengineered process. Some of the main assumptions in the reengineered process were:

- Alternate system of payment (not through bank)
- Revised payment terms for payment
- Computerization linking indentors, purchase, stores, and finance
- Online vendor rating system
- Evaluation, selection and monitoring of vendors
- Enhanced authority for management staff to place purchase orders
- Minimum role for finance department
- Minimum signatures

13.2.4 Implementation

The next step was implementation. Various recommendations were made out from the reengineered process map. Quality Improvement Teams were formed, clearly

defining responsibilities, benefits, costs, expected benefits, expected difficulties, time deadlines, etc.

Some of the recommendations were:

- Develop vendor rating system and build a vendor database
- Develop a system of indent planning
- Design information technology solutions
- Identification and disposal of surplus materials
- Increase number of annual rate contracts
- Revision and delegation of authority of management personnel
- Develop quality system for inventory management and incorporate under existing ISO: 9000 system

13.2.5 Implementation Barriers

The team that redesigned the process was attempting to 'sell' *Change* (a reengineered process), which many were not willing to 'buy'. But the team 'pushed' it through owing to perseverance and support of the sponsor of the project, i.e., the executive director.

Key barriers faced during implementation were:

- Resistance to introduce planning in indents requisitioning
- Elimination of 'parallel' stores (reduced 'comfort' level)
- Increased accountability and responsibility (lesser signatures)
- Revision of payment terms for vendors

Strategies adopted to overcome the barriers were:

- Massive communication across the organization, highlighting the benefits of the reengineered process.
- Identification of people who were supporting or opposing and the fence sitters in the change process. Use of peer/superior pressure, cajoling, counseling, etc., reduced/neutralized restraining forces
- Intervention by top management
- Regular monitoring of progress of Quality Improvement projects

13.2.6 Benefits of BPR Implementation

- Savings of approx. Rs. 11 million (US$ 0.3 million)
- Reduced inventory, with reduced inventory carrying cost
- Lesser lead times

- Process automation, fewer process errors, ease of data collection, analysis, access
- Better stores management, additional space
- Simpler and user friendly process
- Lesser inter departmental conflict
- Number of steps to complete the process down from 51 to 16
- Elapse time down from 306 days to 123 days
- Reliable vendors with minimum follow up
- Smoother plant operation

13.3 A US-BASED MULTINATIONAL INDUSTRIAL SUPPLIES MANUFACTURER

Global competition is driving organizations to become leaner and more streamlined. Many organizations have turned to business process reengineering (BPR) as a means to radically change the way they conduct business. However, dramatic improvements have failed to materialize in many instances. Here, a case study is undertaken to deeply explore one organization's experiences with radical change for the purpose of uncovering how they achieved success (David J. Paper, James A. Rodger, Parag C. Pendharkar, 2001). The organization examined is a US based multinational industrial supplies manufacturer. From the data, a set of lessons are devised to help others transform successfully.

13.3.1 Methodology

Case study analysis of the organization began with a site visit on August 16, 1997. Data were gathered through late 1999 from interviews, annual reports, observation, e-mail, and informal discussions. Three people were formally interviewed, including the Director of Strategic Planning and Organizational Development, the Manager of Worldwide Manufacturing Programmes, and the Manager of Distribution Systems. Contact was consistently maintained via telephone, e-mail, and fax. The interviews lasted between one and two hours. A set of open ended questions related to BPR were used to guide interview discussions. However, spontaneity was encouraged by allowing respondents to discuss any issues they considered important to the research. Transcripts of the interviews were transcribed within two days to reduce information loss.

13.3.2 The Total Plant Paradigm

The paradigm was based on four principles of success-process mapping, failsafing, teamwork, and communication. Each of these principles is critical to realizing the

Total Plant. However, every team member was required to be educated in all four principles and empowered to use what they had learned to solve business and manufacturing process problems. The major obstacle to change was the employee attitude that *'things are OK', so why change.*

Total Plant developed a need for people to change. It created a level of dissatisfaction. To see what was happening, and to benchmark, key people were sent to another similar organization, a competitor.

When the people returned, they felt depressed because the other organization was better. This made them realise that there was need for improvement. They wanted to beat the competitor. The paradigm gave them a foundation to work (Manager Distribution Systems, personal communication, August 16, 1997).

13.3.3 Information Technology

The organization under study depends on information technology (IT) automation to keep its plant in operation. It produces automation and control devices that must meet stringent levels of quality because its customers would accept nothing less. Its devices are very sophisticated and require complicated processes to manufacture. The role of the worker is monitoring of devices to make sure they are performing within strict tolerances. Therefore, information is 'built into' the systems that build other systems. Information that supports manufacturing is viewable at each production cell through colour monitors and other visual devices.

13.3.4 Execution

The organization has four mechanisms in place—process mapping, failsafing, teamwork, and communication, for promotion of an enterprise wide integrated plant. *Process mapping* is a systematic BPR methodology to guide team process improvement efforts along process paths. *Failsafing* is a vehicle to help process teams identify and correct defects quickly and permanently. *Teaming* is encouraged through *communication* of vision and rewards based on value added activities. These four mechanisms facilitate successful change, but do not guarantee it.

What separates success from failure is execution. Top management should be willing to dedicate substantial training resources to educate the workforce about the four mechanisms and the way they work. Management behaviours need to change from autocratic to facilitative. Teams should be rewarded for enterprise value added activities. Finally, the organizational structure needs to change to allow an environment conducive to innovation. Execution flows from the corporate vision statement and strategic plan down to management and workers. The vision statement should reflect the desired outcomes. Moreover, the strategic plan should incorporate specific steps, policies and standards that would make real change

happen. Top management should live the new paradigm by being active participants in the change process, only endorsement is not enough. They need to interact with teams and management to let their people know that change is a priority and that they understand what is being done at the process level to make change happen. Top management, therefore, should facilitate the paradigm through resources, executive actions, rewards, and recognition.

In this organization, the path toward change is probably much smoother than in most organizations because it has embraced change for many years. It is a pioneer in quality management and has always developed its people through training programmes and rewards for value. Hence, execution is easier and resistance is not as big an issue. However, problems did occur. The biggest obstacle to execution was within the middle management ranks. Members of this level were too used to being experts in specific areas. For instance, one operations manager, a resident expert in materials flow, managed technology, engineering, and manufacturing people. He managed sub-optimally because every problem was solved through materials flow. He was unable to see the cross functional or cross specialization nature of the problem because of his narrow focus on materials flow. He had to 'let go' of his expertise and let his people solve the problem as a cross functional team. It may sound like a simple change for this manager, but it took years. Behavioural change is the most difficult type of change. It takes time and patience. Execution of a major change programme therefore requires a lot of time to reap the desired benefits. With quick profits and impatience the norm in many organizations, execution would be the biggest hurdle to success. Adoption of mechanisms, like those used in this organization, are therefore worthless without a plan for change and proper execution of that plan.

13.3.5 Lessons Learned

From this case study, a set of general lessons were developed. The case experience allowed to speak in-depth with people involved in enterprise transformation. That should make the lessons more practical.

Lesson one: People are the key enablers of change Business processes are complex, but process mapping offers a comprehensive blueprint of the existing state. The blueprint enables systematic identification of opportunities for improvement. IT is complex, but vendors, consultants, and system designers can create models of the system. In contrast, people are unpredictable. They cannot be modeled or categorized universally. However, people do the work, and therefore must be trained, facilitated, and nurtured.

Lesson two: Question everything Allowing people to question the way things are done is imperative to change. Failsafing provides a systematic approach to effectively question the status quo. People are encouraged to question the existing state.

Lesson three: People need a systematic methodology to map processes Process mapping is the mechanism used to map and understand complex business processes. The systematic nature of the process mapping methodology keeps people focused and acts as a rallying point. Moreover, process mapping provides a common language for everyone involved in the project.

Lesson four: Create team ownership and a culture of dissatisfaction Once a team perceives that they 'own' a project, they tend to want to make it work. It becomes 'their' project. In addition, management should encourage people to be dissatisfied with the way things are currently done. However, punishing people for complaining about ineffective work processes is an effective way to promote the status quo.

Lesson five: Management's attitude and behaviour can squash projects If the managerial attitude remains that of 'command and control' and/or their behaviour does not change, transformation would most likely fail. Success depends on facilitative management and visible and continuous support from the top. When the organization got its new president in 1996, the attitude toward criticism changed dramatically. The new president was not as accepting of casual criticism. Criticism of the status quo had to be based on well-thought-out ideas and presented with the logic behind their thinking. This drastically reduced the complaints about existing processes without justification.

Lesson six: Bottom-up or empowered implementation While support from the top is critical, actual implementation should be carried out from the bottom up. The idea of empowerment is to push decisions down to where the work is actually done. Process mapping and failsafing are two systematic and proven methodologies that help support empowered teams.

Lesson seven: BPR must be business driven and continuous, process improvements should be aligned with business objectives.

Process mapping, failsafing, and teaming should be based on what the business needs to change to become more successful. In this case, effective communication of ideas from top management throughout the enterprise is imperative. In addition, organizations should be wary of the 'I've arrived' syndrome. Change is continuous and is never over.

Lesson eight: IT is necessary, but not sufficient Enabler IT is not a panacea. IT enables BPR by automating redesigned processes. However, information is for people. People work with people to produce products for other people. In addition, people need quick and easy access to quality information to help them make good decisions. Therefore, IT needs to be designed to support the business and the production of products to be effective.

Lesson nine: Set stretch goals Goals should be set a little higher than what the team believes they can accomplish. Since teams have little experience with the new paradigm, goal setting would tend to be based on the past. Project managers should work with the team to help them develop stretch goals.

Lesson ten: Execution is the real difference between success and failure This case introduces four powerful mechanisms to facilitate enterprise change. However, real change will not happen without a plan for change and aggressive execution of that plan. This is where most organizations fail. Execution fails in many cases because the organizations are not willing to dedicate resources, time, and energy to the effort.

13.3.6 Caveats and Conclusions

The major limitation of case study research is sample size that limits generalisability. A specific limitation is that this case is industry specific. The organization is a manufacturing plant that produces special high quality controls. Customers demand world class quality that pushes the organization to continually improve. Different industries, and organizations within those industries, have different environmental forces to deal with. Both of these limitations reduce generalisability. However, transformation is a new area. It is very dynamic and the scope is enterprise wide. Although case studies rate low on generalisability, they rate very high on data richness. By researching the organization's transformation paradigm, some very important insights regarding successful change can be uncovered. Most importantly, it was discovered that execution separates this organization from other organizations involved in transformation. Nine other important change lessons were identified. It was concluded that the only way this information could be collected was through the case study methodology.

Another major issue is dealing with change. Change is painful and difficult to implement. However, it is a fundamental aspect of BPR. Organizations should, therefore, openly deal with change. Top management needs to communicate to its people why change is necessary and how it would impact everyone's current job and future with the company. It needs to convey to its people that BPR is not being used to replace workers, but to improve quality, reduce cycle time, and create value for customers. Patience is also needed. Change takes time.

13.4 CASE OF A FIRM FROM THE BANKING SECTOR

BPR can also be applied effectively in service organizations, like the banking sector. In this section, an example of business process reengineering application from the banking sector is discussed (Roger Maull and Stephen Childe, 1994). Traditional

methods of improvement had previously focused on internal departmental improvement, using O&M and TQM analyses, with only limited success. This case study shows how a whole process based analysis was used, initially looking for process improvement, and later for reengineering.

13.4.1 Methodology

The bank established a five stage approach to BPR:

1. **Develop strategy**: Develop vision, critical success factors and stretch goals
2. **Identify key processes**: Related to critical processes, guided by the strategic phase, also define performance factors
3. **Analyse existing processes**: Including modeling the existing process
4. **Develop an improvement plan**: Involving redesign and strategic reengineering
5. **Implementation**: Develop/build prototypes, gaining commitment, develop IT support systems

The bank adopted this comprehensive approach to BPR as a means of radically re-focusing the organization on its customers. The underlying focus was first to establish 'quick wins' and attempt to remove 'price of nonconformance' through process simplification, and then to specify the radically reengineered processes for implementation over a 12 month cycle. The bank completed work on two major processes using this five stage approach. However, for reasons of confidentiality, this case will concentrate only on the application of stages three and four–analysis and improvement.

The approach to modeling was based on a combination of IDEF and flow charting. IDEF (Integration Definition) is a family of modeling languages in the field of systems and software engineering. They cover a range of uses from function modeling to information, simulation, object oriented analysis and design and knowledge acquisition. These 'definition languages' have become standard modeling techniques. Specifically, the initial (and most widely recognized) languages are $IDEF_0$, that is a functional modeling language building on SADT, and $IDEF_1$, that addresses information models. An adaptation of $IDEF_1$, called $IDEF_{1X}$, was subsequently created to address database design issues. The IDEF languages were developed under funding from US Air Force and, as such, are in the public domain.

$IDEF_0$ is fast becoming the standard process modelling technique and is used within a variety of service industry companies, including ICL, IBM, Natwest, TSB, Portman and Scottish Power, and is the modelling base for BPR offerings of majority of big consultancy firms.

13.4.2 Results

The models developed at the bank covered a variety of processes; the example given in Fig. 13.1 shows one of a whole suite of models that cover the mortgage process. The figure summarizes the main information flows within the process that supports the provision of the mortgage product. (It is important to note that a whole suite of models, decomposed to seven levels, summarizes this process; this diagram is shown as an example.) The process begins with some initial contact with the client (A11), who is then asked to attend an interview. At the interview, a variety of data is collected (A12) on to a variety of forms, for example,. mortgage application form, financial advice form, MIRAS, life and general insurance, etc. All these data are then collated and checked off against a checklist (A13), before being sent off to the central mortgage processing unit. This group then assesses the mortgage application against existing funds availability and sets up billing procedures (A14). If the mortgage application is standard, i.e., if it falls within set parameters (for

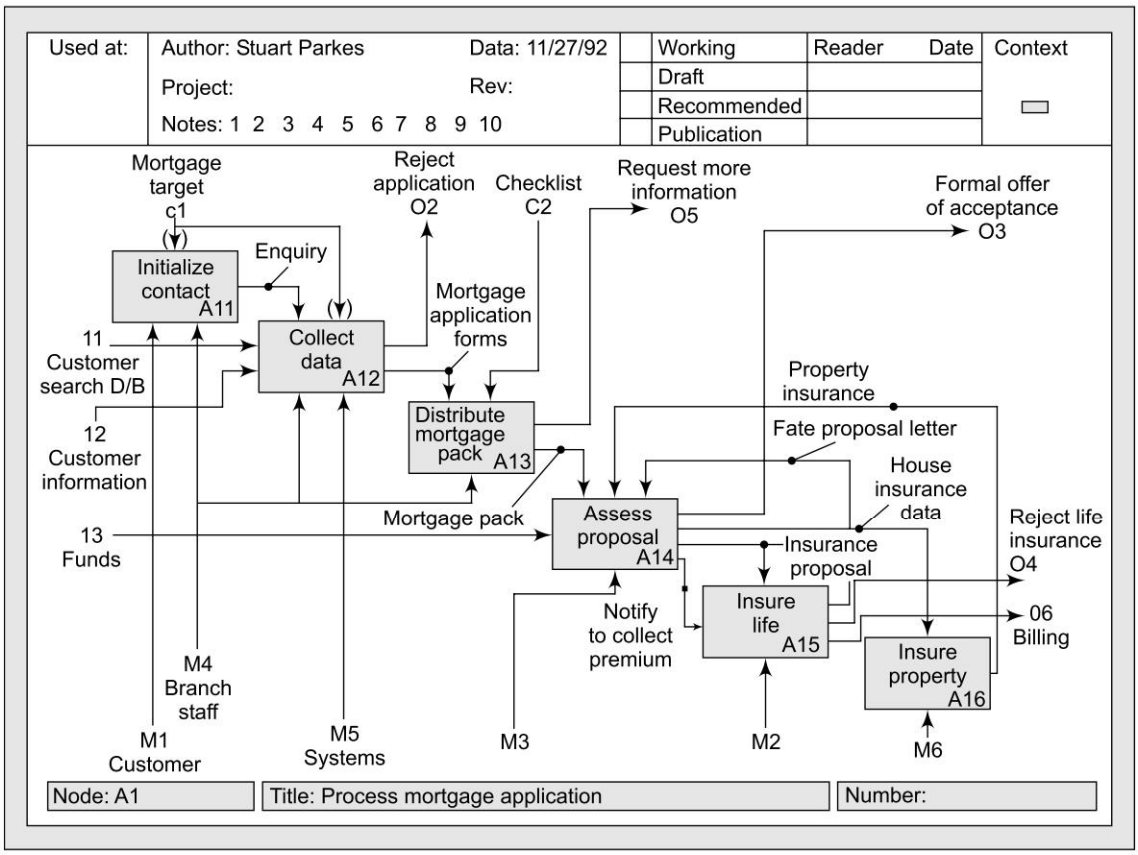


Figure 13.1 *Example of One of the Models Covering the Mortgage Process*

example, height/weight ratios), then life insurance is set up at the same time. If the application falls outside these parameters, then the proposal is sent on to the central mortgage processors for life insurance to be established (A15). The same process applies to general building and contents insurance, the separate property insurance activity (A16) occurring if the proposal falls outside predetermined parameters. Feedback from life (M2) and property (M6) enable the central mortgage processors to issue a formal offer of acceptance (A14). The $IDEF_0$ models were helpful in identifying areas for improvement in three main ways. First, they acted as a means of understanding the process, which had never previously been modelled in so detailed a manner. Second, because of the hierarchical nature of $IDEF_0$, the models were useful in communicating this understanding of the process to senior executives. In essence, because $IDEF_0$ insists on consistency among levels, yet allows for abstraction of terms, the models could be shown in strategic meetings where radical reengineering decisions were made. Third, the models allowed an analysis of the process to take place. Two types of change were identified—*incremental*, that had a 6 month implementation cycle, and *radical*, that had an 18 month cycle.

The incremental analysis was based on the streamlining activity, and focused on detailed diagrams, four and five levels down in the hierarchy. In this case, the team analysed the models and looked for opportunities to

- Reduce bureaucracy, where unnecessary administration, paperwork and checking were taking place
- Reduce duplication
- Reduce process cycle times
- Use simple language and simplify forms
- Undertake value added assessment, using the criterion, 'Would the customer pay for this activity?'
- Reduce the number of exception routines

The radical team used the models at the higher levels of the hierarchy, and sought to identify where IT could be used to eliminate whole activities. It was then necessary to analyse the whole activity for all its inputs and outputs, for example, to ensure that the next stage in the process still had all the inputs necessary to carry out its task. This was a strategic level decision, and was well supported by the high level diagrams.

After modeling the process, the bank was able to identify clear areas where 'quick wins' were possible. These included:

- Focus on block policies that represented a quarter of the cost of standalone policies
- Improvement in documentation from branches

- Issue of guidelines on the need for clarity in handwriting on application forms
- Rekeying of data in central mortgage processor, insurance and branch
- Establishment of quality centres to ensure requisite accuracy of forms
- Control on too much movement of paper
- Faxing and posting of forms
- Speed of computing support for underwriting

However, these improvements were process simplifications, incremental rather than radical improvements. The radical improvements to the process were to be implemented in the second phase. These were expected to reduce the number of activities involved in the mortgage process by a factor of 10, and, instead, were to rely extensively on enhanced use of fourth generation languages and expert systems.

13.4.3 Conclusions

This case has attempted to summarize the major influences affecting the approach to business process management developed by the authors. The key drivers are strategic to develop lean processes that are then used as a basis for developing strategic capabilities. The key mechanism is process modelling. The approach adopted at the bank was based first around modelling the existing process, and then seeking to improve through either reengineering or process simplification based around quality improvement teams. The case adopted an approach that facilitated both these elements of change through the use of a systematic method that incorporated a number of techniques based around the use of $IDEF_0$.

The business process movement is heterogeneous, with no single driving force. It takes account of measuring work; it uses TQ concepts, such as empowerment and modeling processes; and it is closely associated with the application of new IT concepts. It combines all these into a radical rather than incrementalist approach to change, focused on the process. The focus is not on the improvement in efficiency of individual departments, as in O&M, but on how whole processes can be made more efficient and more effective.

Summary

This chapter discussed the three successful cases of BPR implementation in different organizations belonging to different sectors. The cases also brought to light some important aspects of BPR implementation, like formation of teams for implementation, current process

analysis and new process design, importance of people and IT, concepts of process mapping, dealing with change, failsafing, communication and the $IDEF_0$ modeling technique. The cases demonstrated that a correct approach to BPR implementation leads to successful implementation of BPR in any organization.

Review Questions

1. Discuss the Westinghouse Technology for Improvement of Processes (WesTIP) adopted by the oil refinery. Compare this with other BPR methodologies you have learnt.
2. Discuss the total plant paradigm methodology with respect to US based multinational industrial supplies manufacturer. Also discuss the general set of lessons learnt from this case.
3. Discuss the $IDEF_0$ model of BPR developed by the bank. Develop such a model for a banking process other than the one discussed in the case.
4. Make a comparative study of general barriers to implementation of BPR observed in the three cases. Suggest solutions to these barriers by quoting examples from cases of any other BPR organization you have come across.

Suggested Readings

David, J. Paper, Utah State University, Utah, USA, James A. Rodger, Indiana University of Pennsylvania, USA, and Parag C. Pendharkar Penn State Harrisburg, Pennsylvania, USA, 'A BPR Case Study', *Business Process Management Journal*, vol. 7, No. 2, 2001, pp 85-99, MCB University Press, pp. 1463–7154.

Roger Maull and Stephen Childe, University of Plymouth, Plymouth, UK, 'Business Process Re-engineering: An Example from the Banking Sector', *International Journal of Service*, Industry Management, vol. 5, No. 3, pp 26–34. MCB University Press, 0956–4233, 1994.

Thawani, Sunil *BPR—Winning Edge Case Study of Indian Refinery*, 4th Middle East International Quality Conference, Bahrain, 1999.

GLOSSARY

Action plan It is a document used to guide the implementation of business process improvements and contains task assignments, schedules, resource allocations, assignments, and evaluation criteria.

Activity It is a named process, function or task that occurs over time and has recognizable results. Activities use up assigned resources to produce products and services and combine to form business processes.

Activity analysis The breakdown of an enterprise into manageable segments for detailed analysis regarding cost and performance is called activity analysis.

Activity-based costing It is a form of cost accounting that focuses on costs of performing specific functions (processes, activities, tasks, etc.), rather than on costs of organizational units. Activity-based costing generates more accurate cost and performance information related to specific products and services than is available to managers through traditional cost accounting approaches.

Activity-based management It is a system of management that seeks to optimize value added activities performed by the enterprise while at the same time minimizing or eliminating non-value added activities, resulting in overall improvements in effectiveness and efficiency of the enterprise in serving its customers.

Activity dependence It is a phenomenon of an activity intermeshed with other activities in such a manner that the first (i.e., dependent) activity cannot be executed until one or more outputs of other activities within the process have been received.

Activity measure It is a performance value assigned to an activity's primary output.

Activity model It is a graphical representation of a business process that exhibits the activities that make up the business process to any desired level of detail. An activity model reveals interactions between activities in terms of inputs and outputs while showing controls placed on each activity and the types of resources assigned to each activity.

Activity, non-value added Any activity that provides a negative return on investment or allocation of resources to that activity is called non-value added activity. Within broad limits, the enterprise benefits by allocating fewer resources to non-value added activities.

Activity, value added Any activity that contributes directly to the performance of a mission and could not be eliminated without impairing the mission is called value added activity.

Architecture It is an organized framework consisting of principles, rules, conventions, and standards that serve to guide development and construction activities such that all components of the intended structure will work together to satisfy the ultimate objective of the structure.

Attribute It is a property or characteristic of an entity. An attribute has a name and a value. Attributes are used to identify and distinguish between entities as well as to provide descriptions of entities. Attributes are named with singular, generic nouns.

Benchmarking It is a method of measuring processes against those of recognized leaders. It helps establish priorities and targets, leading to process improvement. It is undertaken by identifying processes to benchmark and their key characteristics; determining who to benchmark; collecting and analysing data from direct contact, surveys, interviews, technical journals, and advertisements; determining the 'best of class' from each benchmark item identified; and evaluating the process in terms of the benchmarks set and the improvement goals.

Best practice It is a way or method of accomplishing a business function or process that is considered to be superior to all other known methods.

BPR Business process reengineering (BPR) is a radical improvement approach that critically examines, rethinks and redesigns mission product and service processes within a political environment. It achieves dramatic mission performance gains from multiple customer and stakeholder perspectives. It is a key part of a process management approach for optimal performance that continually evaluates, adjusts or removes processes.

BPR methodology BPR methodology is a structured sequence of activities that constitute a typical BPR project. A typical BPR methodology develops an enterprise level model; identifies scope performance measure, opportunities and constraints; defines the current process and measures cost; benchmarks, analyzes and defines improvement; eliminates non-value added activities; defines improved process (including measurement, cost and simulation); prototypes and field tests; prepares business case analysis; and implements the planned improvement.

BPR principles The principles of BPR form the foundation for achieving dramatic mission performance gains from multiple customer and stakeholder perspectives. These principles include the following:

1. Top management must be supportive of and engaged in reengineering efforts to remove barriers and drive success.
2. An organization's culture must be receptive to reengineering goals and principles.
3. Major improvements and savings are realized by focusing on the business from a process rather than a functional perspective.
4. Processes should be selected for reengineering based on a clear notion of customer needs, anticipated benefits and potential for success.
5. Process owners should manage reengineering projects with teams that are cross functional, maintain a proper scope, focus on customer metrics and enforce implementation timelines.

Business case It is a structured proposal for business process improvement that functions as a decision package for enterprise leadership. A business case includes an analysis of business process needs or problems, proposed solution, assumptions and constraints, alternatives, life cycle costs, benefits/ cost analysis and investment risk analysis. In some government agencies, a business case is called a functional economic analysis (PEA).

Business process A collection of activities that work together to produce a defined set of products and services. All business processes in an enterprise exist to fulfill the mission of the enterprise. Business processes must be related in some way to mission objectives.

Business process improvement (BPI) It is betterment of an organization's business practices through analysis of activities to reduce or eliminate non-value added activities or costs, while at the same time maintaining or improving quality, productivity, timeliness, or other strategic or business purposes as evidenced by measures of performance. It is also called functional process improvement.

Business process redesign The action of analysing As-Is activity models with the intent to construct a To-Be activity model that will yield potential improvements in the performance of the business process.

Business process repository It is a shared database for storing, retrieving and interrelating business models.

Change management Change management is the balanced management of the resources (human and technical) associated with the change initiative. It is about people leading the change effort and those who are expected to implement the new strategies. It is concerned with the organizational culture and the context in which change can occur; and the management of the emotional connections essential for a successful transformation. A number of strategies involved in change management include education, training and communications.

Collaborative work technology It is the term used to describe electronic 'groupware' products that are focused on supporting the interaction and coordination of information, ideas and opinions within a work group. This may include planning, discussion, brainstorming, collaborative design or writing, prioritizing or just about anything that people can do together.

Context It is a statement of purpose, objectives and point of a modelling effort. It describes the part of the organization and its functions that the modelling team will concern itself with, and by implication, what it will not be concerned with.

Continuous process improvement It is a policy that encourages, mandates and/or empowers employees to find ways to improve process and product performance measures on an ongoing basis.

Core technologies competencies These are the methodologies and tools necessary to complete a BPR effort.

Cost It is the price or imputed value of each resource assigned to an activity that is consumed in the process of producing the products and services of that activity.

Cost center It is a function in a business where the cost of producing a product or service is tracked and personnel are held accountable for performance.

Cost drivers These are the factors that cause work to be performed. Determination of negative cost drivers, the factors that cause non-value added work to be performed, is the essence of activity-based costing.

Customer A customer is the recipient of an output product or service and may be internal or external to the organization.

Customer analysis A customer analysis is the collection and dissemination of market intelligence about the customers and their needs. A customer analysis includes both quantitative data (demographics, satisfaction metrics, competitive ratings, etc.) and qualitative (customer profile, behaviour patterns, focus group results, etc.). A customer analysis is a critical element of strategic planning, BPR and TQM.

Data These are the symbols representing instances or occurrences of specific meanings in the real world.

Data administration The application of a consistent set of disciplines and techniques to a definition, organization, operation, supervision and protection of data is called date administration.

Data integration It is an agreement of data messages between senders and receivers enforced by business rules.

Database It is a collection of related data organized to serve one or more independent applications, stored with security, privacy and integrity controls.

Data repository It is a specialized database containing information about data and data relationships. It is used to provide a common resource of standard data elements and models.

Discounted cash flow It is a method of performing an economic analysis that takes the time value of money into account. It is used to remove interest rates and inflation factors from a calculation so that the results of analysis are comparable.

Driver It is an activity or condition that has a direct influence on the operational performance or cost structure of other activities.

Direct costs It is a cost item that can be identified specifically with a single cost object in an economically feasible manner. A direct cost is applied to the cost object based on the actual content of the resources consumed by the cost object.

Economic analysis It is a formal method of comparing two or more alternative ways of accomplishing a set objective, given a set of assumptions and constraints and the costs and benefits of each alternative, such that the analysis will indicate the optimum choice.

Enterprise When used generically, an enterprise is defined as the aggregate of all functional elements participating in a business process improvement action regardless of the organizational structure housing those functional elements.

Enterprise level The enterprise level provides the geographic, technological and managerial platform upon which all information systems development activity is based. It is the foundation that must support all that is built above it in the higher levels.

Enterprise model It is a high-level model of an enterprise's mission, function, process and information architecture used as a standard reference for constructing data and activity models and information systems.

Function A function is a specific set of skills and resources that can be used to perform one or more activities that make up a process. Usually, several functions are associated with a single process.

Functional economic analysis (FEA) It is a technique for analysing and evaluating alternative information system investments and management practices. It is also a document that contains a fully justified proposed improvement project with all supporting data, i.e., business case or decision package. FEA is also called a business case analysis.

Functional management It is a philosophy of management that organizes an enterprise by type of work performed. See also *process management.*

Functional process It is a subdivision of functional activity

Functional process improvement (FPI) It is a structured approach by all or part of an enterprise to improve the value of its products and services while reducing resource requirements. It is also referred to as business process improvement (BPI), business process redesign and business reengineering.

Implementation It refers to the actual installation of the change as per the project's approved recommendations.

Improvement initiative It is a set or package of planned improvements resulting from the analysis of baseline processes, inspection of strategic and business plans and benchmarking of the results that, if implemented, will result in process improvement.

Improvement opportunities These are the situations that can be changed to produce a more effective or more efficient process or product. These may involve processes, business rules or both. Opportunities are often packaged together as an improvement initiative.

Information It is data in context related to a specific purpose.

Information engineering The translation of certain types of process requirements into software programs is called information engineering.

Information system It is an engineered arrangement of computers, communications facilities, software code and data designed to support a business process.

Information technology (IT) Information technology is a package of equipment and/or systems related to data and/or communications that can be used as an enabler of process reengineering.

Integration It is the process of taking discrete products or components and making them work together as if they were one product; or the same concept applied to processes.

Investment justification Investment justification is a functional economic analysis indicating that it is better to do a certain action than not do it. Investments may be compared and ranked by various criteria, including return on various categories of capital, risk-adjusted discounted cash flow, afford ability, internal rate of return, etc.

Just-in-time It is a policy calling for the delivery of materials, products or services at the time they are needed in an activity or process. It is used to reduce inventory, wait time and spoilage.

Knowledge infrastructure It is a set of rules that control the symbols that can be employed in sending and receiving messages.

Life cycle management (LCM) It is a management process that governs a process or system from conception to final disposition.

Measurability It is one of the characteristics that makes an output suitable for being named as the 'primary output' of an activity. Other characteristics include homogeneity and consumption of resources in some direct ratio to the quantity of output.

Methods These are the internal processes that use various tools and technologies to achieve the values, mission and objectives of the organization.

Migration system It is an existing information system that has been officially designated to support standard processes and is intended to be the means of arriving at a target system or architecture (as in open systems architecture).

Model It is a representation of a complex, real-world phenomenon created to find out the answers to questions about the real-world phenomenon within some acceptable and predictable tolerance.

Non-value added activity A process or activity that results in waste of resources or that can be eliminated or reduced without deterioration of service to customers is called non-value added. For example, a corrective process or activity performed because the function initially failed to comply with the customer specifications is a non-value added process or activity.

Non-value added cost The price or cost of any resource consumed by an activity that does not add value to the product or service is called non-value added cost. Non-value added costs are generally the penalty for poor quality or poor decision-making actions in activities 'upstream' of the activity that incurs the non-value added cost.

Performance measure It is an indicator that can be used to evaluate quality, cost or cycle time characteristics of an activity or process usually against a target or standard value. It is an established, consistent way to measure the rate of change within an organization.

Prerequisites These are the **r**elated knowledge and skills required in order to perform work effectively. A *competency* is defined as 'core' if it is important to the performance of a core technology. The BPR team members will be trained in BPR principles, tools and techniques. They must bring the core competencies to the BPR effort. Obviously, if the team member has prior training or work experience that include some or all of the core technologies, little or no training would be necessary.

Present value It is the current value of a future series of cash flows given a discount factor or interest value. It is used to evaluate the alternative investments.

Primary functional output It is a single measurable result of an activity by which the cost of an activity is accumulated.

Process It is a collection of activities that together produce a usable product or service by applying resources from one or more functional areas.

Process action team (PAT) It is a group of 'hands-on' people assembled as part of a total quality management/total quality leadership (TQM/TQL) project to solve a specific operational problem.

Process analysis Process analysis is a combination of graphics and narrative symbols and rules designed to capture the processes and structure of information in an organization.

Process management It is a philosophy of management that organizes an enterprise by the series of activities that combine to produce related types of goods and services for internal or external customers. Also see *functional management.*

Process model See activity model.

Process organizations A process organization is an enterprise viewed from a 'process' perspective. It redesigns the processes first and then determines the optimum organization form needed to make the process work best. The goal of a process organization is to create a high-performance workplace and a high-quality work environment noted for excellence in efficiency, effectiveness and customer satisfaction. With a focus on process, it is very common to see process organizations managing interdisciplinary work teams instead of specialized units more commonly seen in traditional organization charts.

Project management Project management is the ability to define, schedule and assign project activities; record project issues; monitor progress and report changes in activity accomplishment and issue resolution; and maintain and control changes to designs, plans and issue lists.

Program mission It is a statement of purpose that clearly specifies top management realistic expectations. It delineates the program's objectives, scope and viewpoint. It defines the program schedule and budget.

Quality It is the degree of excellence possessed by a product, service or other output of a business activity or business process (tradition definition). The total quality management definition of quality is conformance to the customer's requirements.

Quality function deployment (QFD) It focuses on quality and communication to translate customer needs into product- and process-design specifics. It is also known as the 'house of quality'.

Redesign (business process redesign) It is the transformation of a business process to achieve significant levels of improvement in one or more performance measures relating to fitness-for-purpose, quality, cycle time and cost by using the techniques of streamlining and removing non-value added activities and costs. Redesign projects typically take about six months to complete.

Reengineering (business process reengineering) The radical transformation of a business process to achieve orders of magnitude improvement in one or more performance measures relating to fitness-for-purpose, quality, cycle time and cost; usually requiring the application of technology enablers. Reengineering projects typically take a minimum of two years to complete.

Relationship It is the representation of association between two different real-world objects. A connection relationship has cardinality and may be either specific or non-specific.

Resources These are the enterprise assets that are assigned to activities and consumed (used up) in the process of producing an output product or service. Examples of resources are labour hours, funds, machine hours, materials and contract labour.

Scope It is the breadth and depth of a subject area in an organization or function, which will be analysed in the modelling effort.

Secondary activity An activity that is not primary, but directly supports a primary activity is called secondary activity. Examples may be assigning work and communicating with employees. *(Compare with primary activity, value added activity and non-value added activity.)*

Semantics The unique definitions that describe what is being portrayed by the symbols in a model are called semantics. It refers to the content of a model, rather than its form.

Simulation It is an analytical technique to prove a business practice concept by acting out or by creating the imitative representation of the proposed concept.

Strategic planning Strategic planning is the top management decision process of an enterprise that focuses on the longer range direction of the enterprise and establishes the means by which that direction is reached. It includes the definition of missions and objectives—how the enterprise sees its purpose and where it wants to go. Strategic planning provides the basic direction and focus of the organization, the so-called big picture. Some of the organization's basic strategic decisions might relate to the questions such as: *What business are we in? What business should we be in, now and in the future? What should be the geographical scope of operations? What are our research and development goals? How should products be sourced? Where are we the weakest or strongest?*

Total quality management (TQM) It is both a philosophy and a set of guiding principles that represent the foundation of a continuously improving organization. TQM is a strategic, integrated management system for achieving customer satisfaction. It involves all managers and employees and uses quantitative methods to improve continuously an organization's processes. At the foundation of TQM are three principles: focus on achieving customer satisfaction, seek continuous improvements and fully involve the entire workforce. Achieving these principles requires the establishment of a cultural shift within an organization aimed at making the new culture more participative.

Unit cost The total cost in resource and material to produce one instance of a product or service is called unit cost.

Value-added activity It is an activity in a process that adds value to an output product or service, i.e., merits the cost of the resources it consumes in production. It contributes to producing a designated product or service that meets customer's requirements and that the customer is willing to pay for.

Value-added cost Resources consumed in the performance of a value-added activity are called value-added cost.

Values These are the collective judgements of worth desired and shared with the organization. These are also the specific facts represented by data.

Variable cost It is a cost element that varies directly with the amount of product or service produced by an activity or cost. Variable costs go to zero if the activity stops. See also *fixed cost.*

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