A critical analysis of information technology and business process reengineering

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Abstract: This paper discusses the role of information technology in business process reengineering (BPR). A conceptual model has been developed to illustrate the role of information systems in BPR and the type of information systems required to integrate functional areas in manufacturing. The managers should focus more particularly on information technology (IT) which is designed for mechanising existing processes before using it as an enabling agent of BPR. It is also a major challenge for managers to eliminate forms of work that do not add value, before using technology for mechanising it. Process simplification has been a tremendous interest for managers because information system (IS) is necessary for effective management of material flows in manufacturing. The implementation of BPR using innovative application of information technology (IT) aims at flexible, team-oriented, and cross-functionally coordinated management. A framework has been presented in the paper for the design and development of a more effective BPR system with the help of advanced IT.

Keywords: business process reengineering; BPR; information technology; IT; information system; IS; framework for BPR system; radical change.

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1 Introduction

The modern globalise competitive era has brought change in the organisations and forced to become innovative and adopt new technologies, methods, tools and change approaches. They are viewing the business process and resources as competitors.

Therefore, they are re-designing, re-sequencing their business process and technological resources with time. Recently, BPR has become one of the most important and popular change management approaches which have drawn great attention from academicians and practitioners also.

Business process reengineering (BPR) concerns the fundamental rethinking and radical redesign of business processes to obtain dramatic and sustaining improvements in quality, cost, service, lead time, outcomes, flexibility and innovation (Kuhil, 2014). A group of related tasks that together create value for a customer is called a business process. Common corporate goals have been:

a customer satisfaction

b return on investment

c market share (Hewitt, 1995).

These require process interdependencies 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 business process.

A business process can be identified as the type of commodity that flows through the system. For example, a product development and its transformation into a final product can be viewed as a process. BPR focuses on the whole process, say starting from product conceptual stage to final product design. The focus on process provides the opportunity to reengineer the process or radically reduce the number of activities it takes to carry out a process with the help of modem IT (Hammer, 1990; Hammer and Champy, 1993; Peppard and Rowland, 1995).

New developments in IT such as – image processing, multimedia, and expert systems can be used to reduce the number of non-value added activities (Nielson, 2014). 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 (Srinivasan, 2011). Therefore, a process improvement team should be established with an objective to analyse the whole process and then to identify non-value-added activities such as storage and inspection, and eliminate them. The delivery process highlights cross-functional performance rather than encouraging departmental optimisation and the consequent system wide sub optimisation. The role of IT in BPR can be viewed from two perspectives:

1 the role of IT (e.g., internet, multimedia, EDI, CAD/CAM, and ISDN)

2 the role of technologies themselves (e.g., CD-ROM, ATM, and fibre optics).

IT has played a vital role in the success of overall reengineering initiative, because it has been an important part of BPR as well as organisational enabler (such as – team working, empowerment). Information management throughout the company should be encouraged to develop skills in computer-aided systems engineering (Davenport and Short, 1990; Hewitt, 1995).

Human dimension is also an important factor in BPR and all employees will get affected directly or indirectly. It is identified that employees are often the first casualty of

process reengineering. It is critical to fully understand the human side of BPR in order to implement; complete the process and make it work successfully (Goksoy et al., 2012).

Realising the importance of IT in BPR, an attempt has been made in this paper 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 a stage-wise design of a BPR system. The organisation of the paper is as follows: Section 2 presents the concept of BPR. The role of information technology (IT) in BPR is discussed in Section 3. Section 4 presents a framework for the design of BPR system. A list of suggestions for BPR is presented in Section 6. The final section contains the conclusions of this paper.

2 A recent review of literature on BPR and IT

From the last some years, the number of articles and books on BPR has progressively increased. The key points of some recent existing BPR literature (such as – Goksoy et al., 2012; Mithas et al., 2011; Tønnessen, 2014; Ozcelik, 2013; Bhaskar, 2014) can be summarised in the following statements:

- BPR improves corporate performance significantly through radical transformation.
- BPR involves a fundamental rethinking of how the company does business.
- IT is a key enabler for making transformations of the business possible.
- BPR is a customised approach (i.e., every firm is using it in its own way to fulfil their requirements and needs). The concept of BPR is mostly misunderstood and it is used just for IT induction or redesign of an organisation. It requires an exclusive and universally acceptable model as well as a commonly applicable methodology.

BPR has allowed many successful and failing organisations to re-invent themselves to achieve performance improvements and position themselves in a good place in their markets. BPR re-invent business processes by eliminating old ones to find out visualised ways of accomplishing work by radically and completely redesigned new processes.

The speed of rapid changes in the markets, shorter product life cycles and consumer's high expectations and demands require fundamental changes within an organisation's structures, culture and other management processes (Goksoy et al., 2012).

The business process has to undergo for fundamental changes to improve productivity and quality. The radical changes, as opposed to incremental or adjustment of what exists, are made to create dramatic improvements. Reengineering is not about fine tuning or marginal increases but it is for ambitious companies that are willing to do whatever is necessary to improve the performance significantly. Most companies are function-oriented – or department-oriented – and not process-oriented. Often many people are involved in the order fulfilment, but no one tracks a product and can report the status of an order directly. Reengineering makes one individual responsible for a complete process (Self, 1995).

There are several factors that will prevent reengineering and hence, the innovation and growth such as:

1 correcting the process instead of changing it

2 loss of nerve

3 the barons

4 change of company champion

5 settling for minor results

6 culture, attitudes and skill base

7 skimping on resources

8 pull back when people resist change.

Childe et al. (1994) have presented frameworks for understanding BPR. BPR focuses upon the sequence of activities which form various processes involved in doing business. BPR should enable firms to model and analyse the processes that support products and services, highlight opportunities for both radical and incremental business improvements through the identification and removal of waste and inefficiency, and implement improvements through a combination of IT and good working practices.

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). The organisational restructuring by standardisation and simplification eliminates barriers for a smooth flow of information and hence, an efficient flow of materials along the supply chain. The smooth flow of information can be facilitated by the use of various IT to improve the 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 organisational structure should be modified emphasising simple coordination of the basic business processes in the chain from the suppliers to the customers, as opposed to the existing complex structures of the functional differentially hierarchies (Srinivasan, 2011). The behavioural changes should precede the 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.

Business performance can be improved by mass customisation as well as by simplification. This requires rapid development, flexibility in management and process-based systems. In order to reengineer the business process, the internal and external process capabilities such as: product development, production, distribution, suppliers and markets, and inter-organisational relationship especially in global manufacturing environment need to be integrated. Also, this helps to achieve lean production (LP) through the integration of production activities into self-contained units along the 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 the 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 the 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 the process design. Due to growing concern about the global competitiveness, several initiatives have been undertaken to enhance the competitive position of manufacturing/service companies.

BPR is a structured approach to analyse and continually improve fundamental activities, such as manufacturing, marketing, communications, and other major elements of a company's operation (Elzinga et al., 1995). Collins and Reynolds (1995) presented the experience of Microsoft Ireland's reengineering programme and explained how to solve inventory problems effectively. The company has solved the inventory problems in supply-chain by using online stock control with advanced IT. Kenlaw (1995) explains how IBM's Sales Force Transformation (SFT) business unit provides professional services to Fortune 2000 customers seeking to automate sales and marketing functions. Increasingly sales managers are looking for an integrated system that links front-end departments to manufacturing resource planning and enterprise resource planning systems. By time-based selling, IBM has developed a system to eliminate paper or duplicate order-entry procedures with an objective to increase the accuracy of those orders and to streamline contract writing and signing. All these imply that BPR has the scope for applications in manufacturing/service organisations and IT is an integral part of BPR.

According to Self (1995), there are three things of a manufacturing company needs to do so as to be able to compete effectively:

1 offer an efficient and well automated manufacturing system which is capable of giving the company an advantage over competitors

2 provide a coordinated method of meeting the order-winning criteria

3 reengineer the company's processes in such a way that the product meets order-winning criteria and maximises profit.

This area has the potential for future research and applications. Many believe that technology transfer, in the form of automation, is the sole answer to business problems.

Nevertheless, automation does get some jobs done faster, but no fundamental or radical improvement in performance results without procedure or process changes. Therefore, radical improvements through factory innovation have more to do with a company's ability to change its processes and practice itself than simply automating (Hammer and Champy, 1993). For companies reengineering, the altering of company's in-house procedures and practices, is an essential prerequisite to effective innovation and growth. More often a change in the industrial culture and infrastructure should be necessary before investment in new plant can take effect.

BPR is a top-down, process-driven approach managed by senior executives which aims to improve the performance by radical changes in the system over the short-term (Ardhaldjian and Fahner, 1994). Bhaskar (in press) observed also and clarified that BPR is a totally process-based management tool that can deliver both, either redesign or replace inefficient processes, as required, with a breakthrough result. It can be applied to the whole organisation, part of the organisation or to a single unit with in the organisation.

Companies/organisations usually have to meet three important goals to achieve effectiveness; they are:

1 a process, not product perspective

2 cross-functional coordination or integration

3 consistency between goals and improvement plans (Wickens, 1995).

IT is an enabler to the reengineered process, and any reengineering programme must take account of the tremendous advantage offered by technologies such as document image processing and expert systems (Childe et al., 1994). This indicates that IT can be used to model and analyse business processes and then in reengineering those processes. The implementation of BPR for a radical change in manufacturing strategy requires the attitude to change and the serious involvement of dedicated individuals and teams (Roby, 1995). Smith (1995) indicates that the major aspect of BPR is the human element. Therefore, companies should ensure that their employees are motivated suitably and the technology required for training is available, especially for radical change with BPR. The concepts of time-based competition (TBC) and LP are of considerable significance of BPR. TBC is process based and aims to reduce radically the time required for an entire process. The corresponding benefits may include increased productivity, price competitiveness, reduced risks and increased market share. In the 1980s, total quality management (TQM) helped incremental process improvements in manufacturing/service organisations, but in 1990s BPR using modem IT. This implies the role of IT and BPR in improving the effectiveness of organisations.

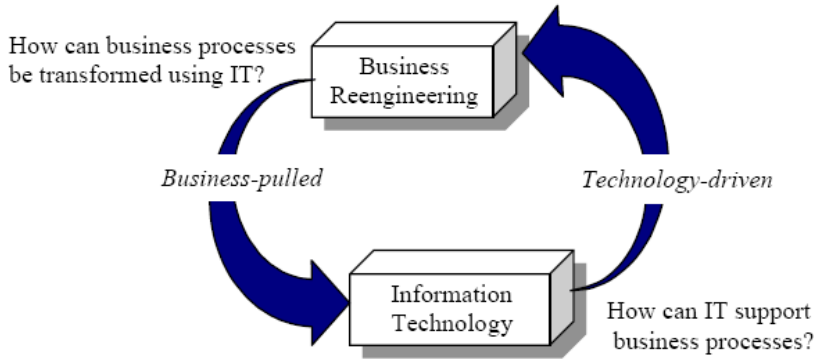
Jones (1995) explains how benchmarking helps to identify and eliminate non-value added work. Benchmarking is one popular technique a plant can use to compare its performance with other plants in similar industries. Combining benchmarking and reengineering ensures that the best practices are in use, and help a firm seek out and eliminate steps that waste resources. This paper focuses on fictional integration from process perspectives. BPR requires major organisational and cultural changes to reengineer their business processes through radical change to achieve a dramatic improvement. For such a change effort, the information system (IS) has to be restructured to support the reengineering of business processes. The restructuring of IS should support functional integration with an objective to improve the management of supply chain and hence, an improved productivity and quality. In the following section, some of the advanced IT are briefed before studying the application of them in BPR.

3 Criticality of IT in BPR

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

ways of thinking and old behaviour patterns. Figure 1 shows that how IT support business processes and how can business processes be transformed using IT.

Figure 1 Identify enabling IT and process redesigns (see online version for colours)



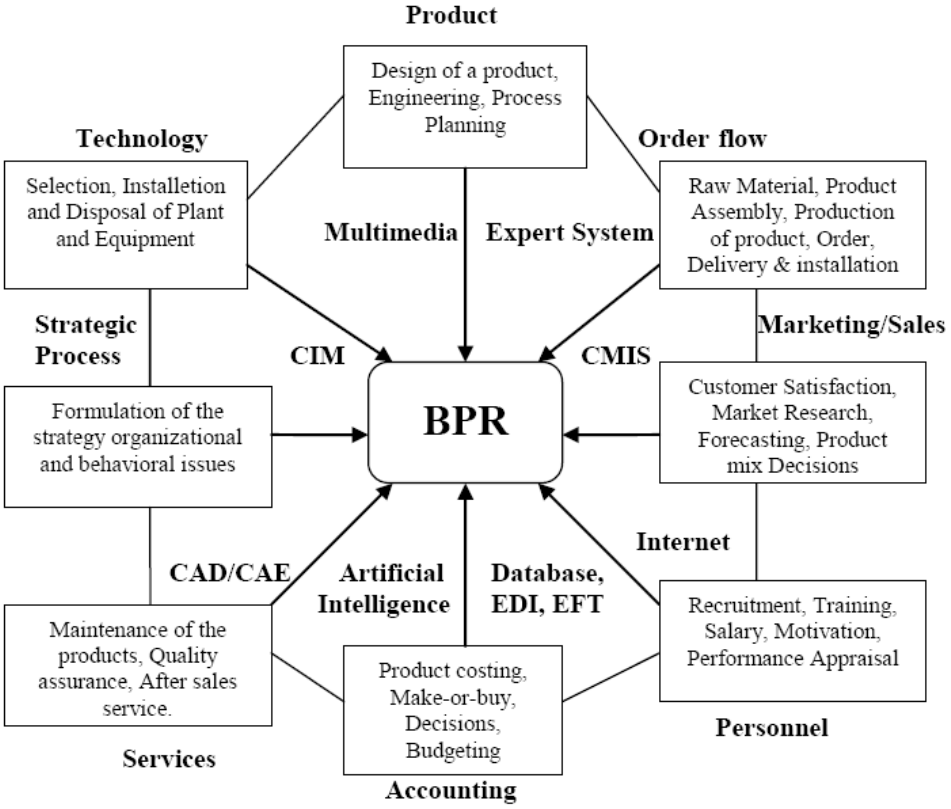
Electronic data interchange (EDI) is usually defined as the computer-to-computer exchange of relevant business data and is a set of agreed upon standards that make transfer possible – it is not a common channel. Typical information exchanged might initially be orders and invoices to suppliers. Additional software advances may help to send order acknowledgements, order notices or electronic funds transfer (EFT) (Sidorova et al., 2015). 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 has been forgotten all too frequently. While EDI used to be expensive and complex, recent advances in packaged software, bar coding, and telecommunications technology that 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 a retailer's sales and inventory data to ensure that replenishment is coordinate as closely as possible with sales rates (Parker and McKinney, 1994). EDI eliminates the barriers between functional areas and within each functional area for a smooth and reliable information flow along various functional areas. 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 the retrieval of useful data. Such information help companies to compete successfully in a global economy and bring new products to 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 linking computer-based tools with various business processes.

For the success of BPR in manufacturing/service industries, IT helps 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, working in rapidly shrinking number of international or industry focused data formats means the pace of EDI implementation is increasing (De Toni and Panizzolo, 1993). In the last decade, MRP II evolved from primarily a materials requirements planning system into something more fully integrated with both 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 systems for logistics and supply-chain management (Parker and McKinney, 1994). A conceptual model is presented in Figure 2 to illustrate the role of IT in BPR.

Figure 2 A conceptual model 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 strategic goals of the company. Nevertheless, the definition of process in a company has a tremendous significance in influencing the system performance and subsequent activities related to reengineering. The process definition used here is broad in context of including the delivery of goods to customers, development of a product, purchasing, recruitment, strategy formulation, technology development and installation.

The model shown in Figure 2 has some major processes. These major processes have been identified based on the critical areas of manufacturing/service industries. The recent literature on improving productivity and quality indicates that there is 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, personnel, form the part of major business processes. For example, treating the product development as a design process requires the design of a product, engineering and process planning. Reengineering the 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.

The details of each of the major business processes and their role in BPR are discussed hereunder.

3.1 Order flow

Defining the process to reflect a drastic change in manufacturing operations will be very difficult to generalise as they should be tailored to the organisational 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 will 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 organisational characteristics, vertical, horizontal or hybrid, the information flow and hence, the corresponding IS 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 based on the function and it should be tailored to the characteristics (organisational 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 standardisation of the flow of materials and hence, the flow of information may facilitate reengineering to improve the overall performance of the system. The congestion at every point in the supply chain should be identified before formulating information strategy.

ISs 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, shared databases, and process team consists 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.

3.2 Strategic process

The external factors influencing the supply chain such as government policies, environmental aspects, inflation, general economic condition in the country, 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 extemalities will 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 a 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 IS. Obviously, the accuracy of the decision depends upon the accuracy of the data collection about both internal and external factors and easy information exchange among people who are the key players in the strategy formulation.

3.3 Product

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. Product itself is an object that requires various aspects such as design of a product, engineering, and process planning. These stages can be integrated using the concept QFD, CE, CAD/CAE and CAPP. The ideas of CE 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.

3.4 Marketing/sales

Marketing and sales are two of the most information intensive functions in business (Powell, 1994). Marketing research in particular will be a 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 will not have to be received 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 issues of purchase orders, receiving invoices and payment of suppliers.

Marketing/sales as a process need integrating activities such as market research, forecasting and feedback with the objective of providing required information to the management of the company 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 manufacturing. 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.

3.5 Services

It is an important element of value adding areas in any organisation that has distribution as the 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 utilisation of equipment, and eliminate unnecessary paper work (through long-term relationships, and computer-control IS).

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 software used. A typical client/server technology has three-level architectures: 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.

3.6 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. Stillwagon and Burns (1993) described the advantages of the application of human performance engineering (HPE) to problems of employee, manager, and organisational development. They have introduced a new method called HPE – of organising, developing, and challenging the human resources of an organisation, utilising geometric or algebraic principles as typically found in engineering analysis together with functional elements of performance. A mechanical and economic visualisation of the relationship within a particular organisation, 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 organisational development using the practical concepts of HPE would help to improve the human factors in BPR. Employees expect their organisations to take a more active role in

addressing the stress they face in managing their work life with their home life, especially in BPR (Stillwagon and Burns, 1993).

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 utilised 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.

4 A framework for the design and development of BPR systems

The successful organisational development for BPR should include:

a a holistic view of the organisation

b an endeavour to accomplish simultaneous changes and improvements on several critical variables such as: cost, quality and lead times; customer and vendor relations; utilisation of technology; organisational arrangements; and employee learning and competence development

c a dynamic and long-term perspective on the change processes

d a development of the work itself and the work-related tasks in terms of influence over change and development processes.

The following four recommendations can help promote a better understanding of business and will increase the chances for BPR success; immediately assemble a cross-functional team, conduct brainstorming sessions early on to define critical problem areas, create a high level current business process map, and formulate a vision statement that represents the team's thinking (Cresto et al., 1995).

The following six steps can be followed in the design and development of BPR systems (see Figure 3). The BPR system should enable firms to:

1 Define business processes and their internal or external customers.

   First, major business process improvements and technology investments should be established and sequenced. Justification and approvals for such process improvements and technology investments need to be established.

2 Model and analyse the processes that support these products and services.

   Decide about the specific changes to be made in organisation, work methods, job design, processes and supporting ISs. This might include detailed procedures, systems specifications, and organisation designs. IT such as computer simulation models, multimedia, object-oriented technology, workflow models can be used to model and analyse the processes that support products and services.

3 Identify opportunities.

   Identify opportunities for both radical and incremental business improvements through the identification of non-value added activities and removal of any waste

and inefficiency. Software available for activity-based analysis can be used to identify non-value added activities.

4 Implement improvements through a combination of IT and good working practices.

Information technologies that include EDI, MRPII, multimedia, CAD/CAM can be utilised to improve the working practices. In addition, these include other equipments, customer relations, supplier relations, etc.

In this stage, managers must make preparation for change, develop necessary systems, and install the reengineered processes and systems. This step includes development, testing, detailed implementation planning and control (Lee Hales and Brian, 1994). Computer simulation models can be used to evaluate the performance of the reengineering business processes.

5 Establish a monitoring system to ensure continuous improvement of the redesigned processes.

Computerised models such as CAN-Q models and online performance measuring tools can be used to evaluate the performance of redesigned business processes.

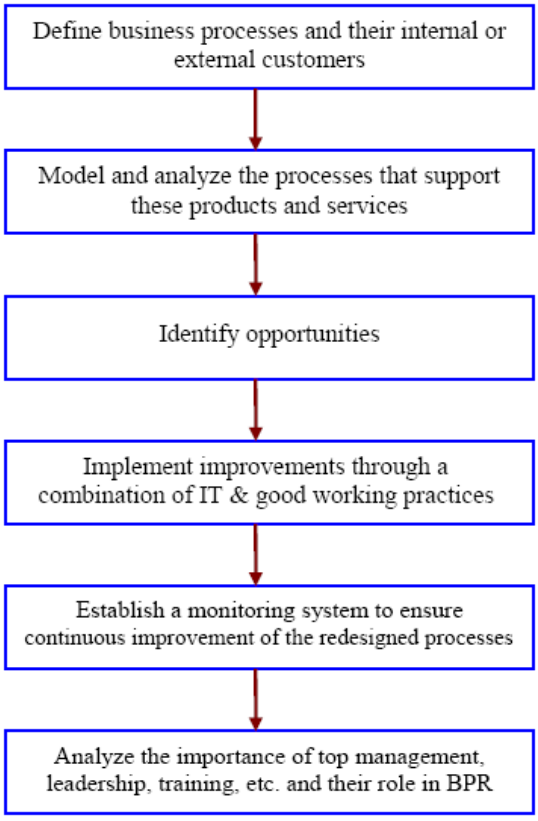
6 Analyse the importance of top management, leadership, training, and reward systems and their role in BPR.

Certainly, IT has the potential to impact these important areas. IT such as multimedia, strategic ISs, and simulation models can be used to motivate the top management in BPR. The following problems of BPR can be overcome by IT as shown in Table 1.

Table 1 Problems in BPR and the role of IT in solving them

Problems	*Information technologies*
Fixing the process instead of changing it	Reengineering by 'process mapping' and 'simulation' with help of computer software
Loss of nerve	Training and education through 'Multimedia system' for a team work
The barons	Executive information system with multimedia capabilities
Change of company champion	Aware of the potential of IT and equip with such IT that would facilitate BPR
Settle for minor results	Benchmarking through information collection using computer databases, EDI
Culture, attitudes and skill base	Multimedia education and training systems
Skimp on resources	Reengineering the information system using CIM, CAD/CAM & EFT for radical change
Pull back when people resist change	Computer-supported cooperative work using multimedia

Figure 3 Steps for the design and development of BPR systems (see online version for colours)



5 Future role of IT in BPR

With advanced IT at a rapid pace, each day of the future role of IT in reengineering becomes more critical. In the survey conducted by Prosci Research and Publishing Company among CEOs of 205 companies across the globe. The future role of IT has been identified into three main categories.

1 Participate as a member of the reengineering team, but do not take control of the project.

2 Define technology solutions to enable new business processes and take time to educate operational managers about new technology.

3 Implement technology needed to support the new business processes. Be sure to set expectations and define deliverables clearly.

IT managers and staff have to become business analysts, knowledgeable of business needs and able to combine a business orientation with technical expertise. This will help in integrating business knowledge with technical skills.

With the advent of internet and e-commerce, businesses are getting closer to the customers. In future, internet will change the way business is carried out. E-commerce will effect reengineering more than present day IT. E-commerce initiatives will be business led activities with an implicit acceptance of process change and often involving the use of high energy change initiatives like reengineering.

6 Suggestions for BPR

In reengineering the business process, the IT plays a major role to integrate various functional areas for reducing the cycle time for the delivery process of the goods/services. BPR requires eliminating barriers within each functional area and between various functional areas for a smooth flow of information and hence, progress of business service processes to achieve a reduction the cycle time of business processes. An IS incorporating various IT will act as a manager for the business processes (projects) to eliminate any sort of congestion or non-value adding activities, and to achieve a dramatic improvement in overall performance of the company. In specific, the suggestions include:

1 More traditional techniques such as cause and effect analysis, Ishikawa diagrams, Pareto analysis, and process flow charting proved to be useful support tools for the process reengineering activities. These should be supplemented by a powerful time-based analytical tool. This analytical tool should use the appropriate criterion and categorise every process step as either useful or redundant. It proved invaluable in identifying process improvement opportunities.

2 The product manufacturing practice for BPR can include enterprise, integration, shared databases, multimedia information networks, product and process modelling, intelligent process control, virtual factory, design automation, supercomputing, product data standards, paperless transactions through electronic information interchange and the high-speed information highway.

3 Successful utilisation of IT requires cultural and organisational change.

4 Companies should start from top-down for reengineering the business process. Reengineering should be distinguished from other business programmes. Once a business programme has been identified as a reengineering candidate, BPR should not just correct it; rather it should strive for quantum leaps.

5 Companies can start by identifying first the business process which forms the critical factor of the productivity and quality. Secondly, suitable IT should be identified that can improve the reengineering programme.

There is a need to analyse the management issues of BPR after reengineering. The team work in BPR should be improved by suitable incentive schemes and continuous training. Computer simulation modelling and analysis can be used to identify the areas of process improvements.

7 Conclusions

Business with some notable exceptions has been slow to harness the revolution in IT. Too often modern technology has been used just to speed up old-fashioned systems. The revolution of software and hardware products, advanced personal computers, relational databases and communications technology enable us to work in entirely new ways.

Information, including sophisticated design processes can be shared on an instantaneous and continually updated basis. Author concluded that reengineering business process is not possible without IT support, because IT is not only an enabler for reengineering; it has also become an essential and integral part of all reengineering efforts. In the implementation of reengineering, IT is crucial and it provides the skills and tools that are needed to effectively reengineer. In the design phase of implementation of reengineering, the capabilities of IT can be used to stimulate a model of the design and there by validate the new design.

IT has to be monitored constantly to determine whether it can generate new process designs or contribute to the performance of a business process. The breakthrough of BPR is closely connected with IT, which opens new dimensions of process reorganisation.

Moreover, those who take the initiative in process redesign/improvement influence the role of IT. If the data processing department initiates the process change, then IT will have more of a generator function for new process redesigns. If on other hand, the top management sets off the change process then process will be first restructured and later optimised through IT.

In this paper, the issues of BPR have been discussed as well as the application of IT in BPR. Many companies address BPR through IT such as document image processing and expert systems. We believe that there is a substantial commonality of processes across industry types. The strategic capability may vary. For example, engineer to order companies will have strengths in the product development process, make-to-stock companies will have to focus attention on the whole logistics supply chain. This should involve using manufacturing flexibility and IT to make the end product highly customised for the end user. Also, service industries need to use IT in their BPR for improving productivity and quality. The following are EDI benefits:

1 reduced handling costs

2 reduced and consistent order cycle lead times

3 reduction in stock

4 reduced risk of lost orders

5 security

6 close relationship with suppliers and customers.

The global view of the pipeline contains complex flows of goods and information through multiple production and distribution channels. To control these flows and provide an efficient logistics system, the flow of goods must be backed up with an accurate and timely IS.

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