The role of BPR in the implementation of ERP systems

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Abstract

Purpose – The role of business process re-engineering (BPR) in implementing enterprise resource planning (ERP) systems is of paramount importance. A variety of approaches are used for such re-engineering as the best-fitting ERP solution can only give a maximum of 80 percent fit with the existing workflow of the organization in which ERP is being implemented. The aim of this paper is to focus on the issues involved.

Design/methodology/approach – The paper presents some sample ERP installations to come out with various types of business BPR, ranging from small-r to big-R, practised while implementing ERP.

Findings – Based on the literature review, it could be found that all organizations implementing ERP have chosen their own approach based on organizational constraints and the needs. The importance of BPR in ERP implementation is highlighted in earlier studies.

Research limitations/implications – The recursive relationship between BPR and information technology has only resulted in the rapid evolution of ERP systems. ERP integration with supply chain management and its web readiness are major agenda for ERP developers. Many re-engineering possibilities are yet to evolve based on research in knowledge, artificial intelligence and expert database systems. A suitable approach to implement the same in an organization can only be done using the most suitable approach and hence the importance of the BPR approaches presented here along with their advantages and disadvantages.

Practical implications – As the various BPR approaches are categorized based on implementation followed by major corporations, it is definitely a forerunner for any ERP-implementing organization under study. Also the common problems encountered during re-engineering for ERP implementation and the suggested remedial measures are presented based on earlier work.

Originality/value – An attempt has been made to identify BPR problems, causes and approaches used in implementing ERP solutions. It is only aimed at synthesis of technical and general issues using the literature.

Keywords Business process re-engineering, Manufacturing resource planning, Artificial intelligence, Databases

Paper type Research paper

Business Process Management Journal
Vol. 15 No. 5, 2009
pp. 653-668

1463-7154
DOI 10.1108/14637150910987892

1. Introduction

The term business process re-engineering (BPR) had its origin at MIT during 1984-1989 while MIT's enumerating management techniques for the 1990s. BPR simply means transformation from function based to process based. The radical redesign of a process is easily achieved by involving information technology (IT) in business processes and hence the prominence of IT in BPR. IT is accepted not only as just a BPR enabler (Hammer and Champy, 1993) but also as an essential enabler of BPR (Davenport and Short, 1998). There exists a recursive relationship between BPR and IT which can be utilized for thorough process change. In the modern times and due to rapid proliferation of computers in the business arena, BPR through IT is getting a big boost. BPR using IT emanated from gradual progression in the use of computers from routine clerical job processing to IT-based decision making. Many corporations reaped benefits by re-engineering their processes at various stages of IT development. At the same time, re-engineering cannot be planned and achieved in small cautious steps for any corporation (Hammer, 1990). In this era driven by fierce competition, companies endeavour to shorten cycle time and improve quality and customer services by adopting newer-process oriented techniques like BPR. Radical BPR and revisionist BPR have been differentiated in the literature (Valentine *et al.*, 1998; Simpson *et al.*, 1999). Business re-engineering or radical BPR is to reshape the entire organization. Revisionist BPR is to focus on smaller scope of change under a process management framework.

2. BPR and IT

BPR differs from other prominent management tools, namely, just-in-time and total quality management, mainly due to the radical change which it can offer as opposed to incremental changes in the existing ways of carrying out processes offered by other tools (Subrata, 1999). BPR is appropriate only if existing weakness of the corporation can be corrected either by combination of strategic means and BPR or BPR alone (Koch, 1995). IT enabled BPR is possible through the implementation of disruptive IT (Burke and Peppard, 1995). IT has the capability to model both structured and unstructured problem solving which can be of wide use in the re-engineering of processes in the ERP system. Information can cut across the boundaries of various functional departments and also across organizational boundaries. This improves the time taken for such transactions and also the accuracy as human intervention is nil in such transfer of information. The process study simulation can be effectively carried out in an electronic media utilizing the power of IT and can easily come out with the best process flow without making any physical changes in the process flow prior to implementing the same. It can even lead to massive improvement in process through disintermediation (Siringinidi, 2000). Electronic tracking of intra- and inter-organizational material flow helps reduce inventory costs to the lowest level possible without ever being out of stock and facing the consequent losses. The above capabilities of IT definitely pave way for improvements in cost, quality, service, and speed which is the prerequisite for BPR.

The pressures of globalization, competition and mergers make it necessary to have intra- and inter-organizational collaboration over digital networks. The scope of re-engineering extends beyond the intra- to inter-organizational level and beyond, utilizing the IT power of modern day digital networks. The scope of re-engineering is extended from intra-organizational processes to inter-organizational processes due to the rapid development in technology and the recursive relationship between BPR and IT. Table I shows constraints and the corresponding IT developments/disruptive technologies which can overcome these constraints. Ford used to pay when they got invoice but they paid after getting goods in the post BPR implementation time, using the benefits of IT.

Sl. no.	Rule	Disruptive information technology
1	Information can appear only in one place at a time	Shared database
2	Only experts can perform complex work	Expert systems
3	Businesses must choose between centralization and decentralization	Advanced telecommunication network
4	Managers must make all decisions	Decision support tools
5	Field office is needed to receive, store, retrieve, and transmit information	Wireless data communication and portable computers
6	The best contact with a potential buyer is personal contact	Interactive communication through the network
7	Manual tracing of raw material, in-process and finished inventory	Automatic identification and tracking technology
8	Plans get revised periodically	High-performance computing

Source: Burke and Peppard (1995)

Table I. Disruptive IT technologies that aid BPR in business information systems

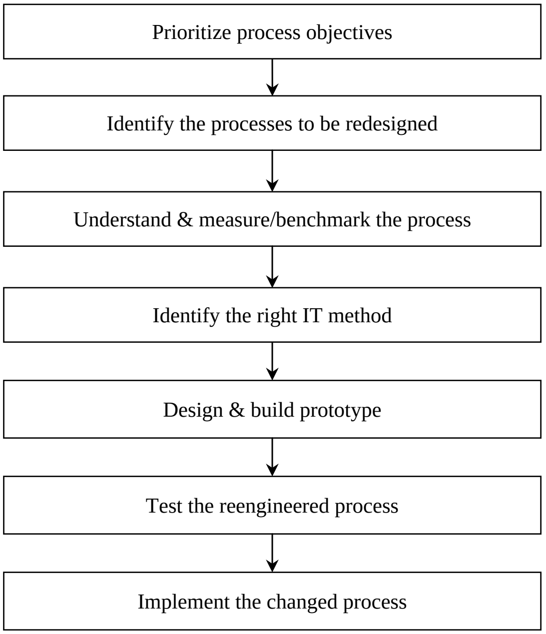
3. Commonly used IT-based BPR tools

Some of the commonly used IT tools for re-engineering are ERP systems, outsourcing, consulting firms, enterprise software, internet, intranet, electronic data interchange (EDI), and legacy systems (Peng and Land, 1999). ERP systems allow sharing of real-time information between manufacturers, customers, and business partners. It is ideal for small companies and medium-size companies to effect better supply chain management (SCM) and better cost and operations management. The quote to shipping time gets reduced considerably from several weeks to few hours after ERP implementation. Outsourcing systems or employing consulting firms during planning and implementation stages rarely works due to conflicting views that cannot be accepted internally by the enterprise personnel. More over, there is a limit to which consulting firms can be involved in internal decision-making process of the enterprise. Use of internet is acceptable from the point of view of increased productivity, better communication, and cost reduction. Security and support are just a few IT concerns in such cases. Intranet provides sophisticated security, than internet, as it is local only to the enterprise. EDI works by transmitting bar code information to control purchasing and inventory. Value-added network is a must for EDI which makes it a costly tool. Now the trend is to integrate EDI with internet which is catching up as a cost effective solution. Legacy systems or main frame-based systems which were used widely before, either support or, are getting phased out by the modern day client server-based systems.

4. Step-by-step procedure for IT driven BPR

A seven-step process as shown in Figure 1 shows the various steps in IT driven BPR implementation (Davenport and Short, 1998; Armistead and Rowland, 1996). These steps are prioritizing processes based on the comparative importance of objectives, identifying the processes to be redesigned, understanding and measuring/benchmarking the existing processes, identifying the apt IT tool, designing/building a process prototype, testing the reengineered process, and implementing the changed process.

The first step is to define the objectives of the process redesign which can be cost reduction, time reduction, improvement in output quality and/or improvement of quality



Source: Adapted from Davenport and Short (1998)

Figure 1. Sequence of steps for IT-based process redesign

of work life. Rarely, organizations become successful in meeting multiple objectives, concurrently. In the second step, selection of the processes to be redesigned is carried out. The two approaches, namely, exhaustive and high-impact approaches are available for the selection of the processes to be redesigned. Exhaustive approach ranks all processes to be redesigned based on the order of urgency prior to the identification of the process to be redesigned whereas the high-impact approach tries to identify only the most important processes which are in conflict with business vision and process objectives. The third step tries to measure the process before redesign in order to avoid repetition and to set a baseline for future improvements. In the fourth step, it is better to have a picture of all latest IT technologies available for redesign prior to the redesign and freezing of the redesigned process under study. The fifth step can be easily dealt with by using IT as a design tool in creating a more generic design of the process under study in arriving at a suitable organizational prototype. After generating the redesigned process prototype, implement the same in one of the units of the organization to study the actual benefits before launching it on an organization wide basis and the same is done in the sixth step. If the pilot launch is found successful in meeting the process objectives, launch the redesigned process throughout the organization which is the seventh and last step in IT-based implementation of the redesigned process.

5. Failure causes for the IT-based BPR systems

Success of any BPR implementation is having a direct bearing on management commitment, basically, by giving support and involvement in the process

(Al-Mashari, 1999; Attaran, 2000). Achieving flexibility from a rigid structure of authority to a flattened cross-functional team is of paramount importance (Attaran and Glenn, 1999). Sufficient training must be imparted to personnel of all levels to prepare them to work in the changed environment. Failure to cope with resistance while implementation can have disastrous impact (Al-Mashari and Zairi, 2000a). Proper selection of first-rate personnel from within and outside the enterprise for assigning re-engineering work is a must for commendable results. BPR is misunderstood as synonym, for downsizing, restructuring or automation by many people in the corporate world. A series of lectures, which highlight what BPR is all about, can work wonders. Change implementation without testing the process change can have harmful consequences. Many IT-based BPR bring out the differential strength among supply chain participants and forces less stronger ones to sell out to more agile competitors (Thomas, 2000). The details of factors which improve the success of the BPR implementation are as follows (Olson *et al.*, 2005; Paper, 2003; Kvavik *et al.*, 2002; Parr *et al.*, 2003; Al-Mashari, 1999; Attaran, 2000):

- availability of financial resources;
- top management commitment;
- clearly defined goals of the BPR study;
- open communication channels;
- flatter organizational structure;
- training to build awareness about the program;
- diverse and knowledgeable personnel in the BPR team;
- testing of reengineered process prior to implementation; and
- technology, mainly, and availability of IT infrastructure.

IT is definitely a BPR enabler. Many aspects related to use of IT in BPR show promising results, especially, in the area of work flow analysis systems. Already corporations have started transforming their system into e-business system to enhance competitive advantage (Hammer, 1990). BPR, in its fullest sense, is possible through IT. Recently, ERP vendors (Montgomery Research, 1998a, b, 1999) are offering ready made solution to tap the IT potential in BPR. While implementing IT solutions for BPR, pitfalls must be avoided as pointed out here. BPR is a creative thinking process and software can be used to store business knowledge in a repository (Jarbek and Ling, 1995). Earlier studies have shown that process-oriented IT systems improves business competitiveness (Keung and Kawalek, 1997).

In a study on ERP system implementation at multi-campus locations, it is stated that the same ERP product can be installed only with significant business process change (Brenner Holland and Sullivan, 2005). There is considerable risk in changing multiple processes at a time. Risk increases if fall back option is non existent and this must be realized by all involved campuses. Streamlining the business processes at multi-campuses prior to implementation of the system makes it easier to implement, maintain and provide ongoing support for the multi-campus systems from both a technical and functional perspective. Previous studies have reported BPR problems and the suggested solutions as given in the Table II (Olson *et al.*, 2005).

The summary of how multinational implementation of ERP in different countries can complicate the BPR process is enumerated as follows:

Table II. BPR problems and suggested remedial measures

Study	BPR problem	Suggested resolution
Al-Mashari and Zaire (2000b)	Anxiety arising out of massive downsizing	Mitigate through communication
	Scope and focus creep	Use project milestones
	Underestimating need for communication	Focus groups, web, e-mail, and newsletters
	Lack of ownership	Demonstrate value
	Technical mindset	Focus on business value
	Lack of IT expertise	Obtain qualified IT staff
Motwani *et al.* (2002)	Hurrying up BPR	Careful planning and measurement
	Lack of training and skills	Sufficient training
	Pressure from top management to implement the system faster	Formal approach with bureaucracy than less rigid system
Sarkis and Sunderraj (2003)	Initial productivity dip	Could be managed through consultants
Yousuf *et al.* (2004)	Matching the process to software	Communication with users
	Data cleanup	Bridging legacy systems
	Lack of training	Training, careful planning, and focus on overall company value
Paper *et al.* (2003)	Lack of analysis of existing processes	Analyze the existing processes
	Lack of feedback opinions from process and legacy experts	Obtain feedback from experts involved in processes
	Violation of ERP vendor promises	Carefully plan and prepare ERP software contract
Kvavik *et al.* (2002)	In a survey based on 500 educational institutions, 60 percent reengineered as a part of the ERP implementation, 13 percent reengineered in advance before implementing ERP and 22 percent did no re-engineering	102 educational institutions, out of 500 institutions included in the survey, opined that they would change the way they did business process redesign if another chance is given. This means that re-engineering skill can only be improved through experience. So training can work wonders
Parr *et al.* (2003)	Vanilla implementation with less customization of the software was adopted in two cases. Processes were not reengineered to suit the software due to fear from employee resistance in one case. In the second case, change was readily accepted by employees when proposed by an expert colleague	Balanced team, clear definition of scope and goals, management support and empowered decision makers could make the implementation more effective

Sources: Olson *et al.* (2005); Paper (2003); Kvavik *et al.* (2002); Parr *et al.* (2003)

- comparative cost analysis of various ways of carrying out the process results in change of best practice in the country itself;
- different legacy systems and middleware practice in different countries;
- local regulations practiced in a country;
- cultural resistance to change; and
- variations in the level of computer skill in people of various countries.

6. BPR-ERP nexus

BPR is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, and service and speed (Leon, 1999; Berrington and Oblich, 1995; Dixon *et al.*, 1994; Hammer and Champy, 1993; Hammer, 1996). Business process management is the convergence of technologies with process management theories. The convergence of process design and implementation approaches results in process enterprise (Hammer *et al.*, 1999). This helps in providing reusable standardized and measurable processes that can be networked. The underlying business applications are separated from the business processes thereby providing flexibility to support changing business processes. Shared database eliminates the barrier across various functional departments of an organization and helps reengineer business processes without any functional barriers. This resulted in solutions heavily influenced by ERP systems being implemented. A wide spectrum of approaches, BPR implementation, exists ranging from technology enabled re-engineering to clean slate re-engineering. If ERP system is chosen first, then the re-engineering is driven by the chosen ERP system or re-engineering is technology enabled. Costs involved with such re-engineering are very low as alteration done on the system is least or none. In clean slate re-engineering, design starts from scratch and ERP system software is highly customized to fit the processes of the enterprise in discussion. Costs associated with the development of such systems are many times higher than technology enabled re-engineering. There is a set of advantages as well as disadvantages which is inherent with each of these BPR implementation methodologies (O'Leary, 2000). Clean slate approach is more suited to large firms with the following criteria:

- afford cost and time for development of such systems;
- requires unique solution; and
- uses processes as key for strategic advantage.

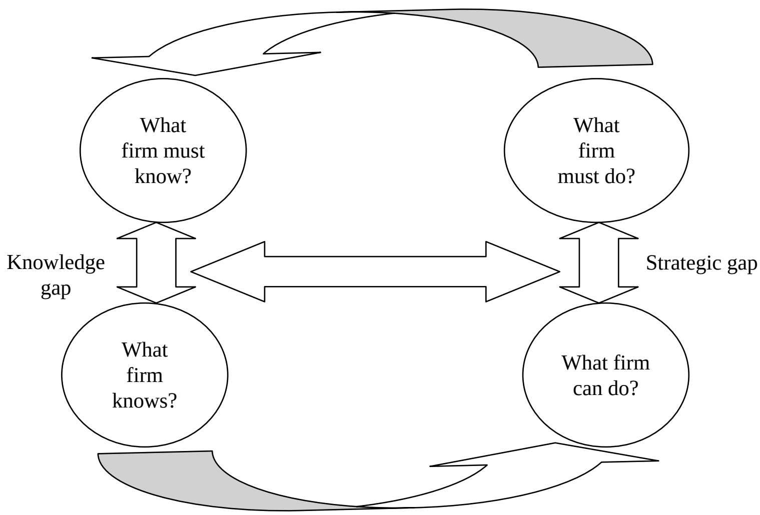
As ERP systems achieve seamless integration through information flow across the various functional areas of an organization, this technology tool enables BPR. It is certainly true that IT and BPR have recursive relationship which simply means that any elemental improvement in any of these brings in improvement in the other (Davenport, 1998; Davenport and Short, 1998). Thus, ERP system qualifies as a potential candidate for BPR in an internet environment. Simple, understandable, structured process to guide the organization in its re-engineering efforts is a pre-requisite for any BPR program. Value-delivery process (VDP) must extend back to include suppliers and also must extend forward to encompass customers (Berrington and Oblich, 1995). VDP must be reviewed in the light of identified critical success factors which can ensure competitive performance.

A detailed step-by-step procedure when followed will simplify the task of BPR implementation (Ballé, 1995).

7. BPR from a strategic perspective in ERP implementation

Many earlier studies have identified BPR as one of the critical success factors in ERP implementation projects (Bancroft *et al.*, 1998; Bingi *et al.*, 1999; Holland *et al.*, 1999; Nah *et al.*, 2001; Al-Mashari and Zairi, 2000b; Parr and Shanks, 2000; Willcocks and Margetts, 1994; Davenport, 1998; Markus *et al.*, 2000). Existence of comprehensive measurement systems that provide a feed back mechanism to track implementation efforts, identify gaps and deficiencies in performance and recommend actions to fine-tune the situation helps achieve desired business value (Al-Mashari *et al.*, 2000b). Such measures must be visible, meaningful, less in number, consistently and regularly applied, quantitative, and must involve personnel dong the actual job (Kale, 2000).

Main factors, concerned in BPR during ERP implementation, as identified based on field surveys with BPR experts, are ability of the project to bring in radical change, how structured is the project, potential for IT application and customer focus (Kettinger *et al.*, 1997). If BPR is seen as consequence of ERP implementation, strategic importance BPR is lost (Esteves *et al.*, 2002). Usually, in ERP implementation, redesigning of the business process takes place at the tactical level for aligning the ERP system and business processes. In addition to that a shift from function-oriented thinking to process-oriented thinking is achieved using BPR which transforms the long-term behavior and strategy than short-term change in organizational behaviour (Kale, 2000). Strategic view of BPR explains its importance as a tool that will bridge the strategic gap by reducing knowledge gap using suitable ERP systems. ERP systems are evolving based on knowledge created through the experience of successful companies and therefore implementation of the same plugs the knowledge gap to some extent in the organization in which it is being implemented. This will in turn reduce the strategic gap in the organization as to what it can do versus what it must do. Figure 2 shows



Source: Adapted from Tiwana (2000)

Figure 2.
High-level Zack framework

high-level Zack framework based on strategic knowledge gap analysis. Reduction of knowledge gap closes the strategic gap in an organization.

Matrix on the magnitude of change versus scale of effort involved in BPR is also found in the literature (Bancroft *et al.*, 1998). Efforts are under way to come up with a useful measurement matrix for BPR implementation than merely going by conventional measurements based on time milestones and cost aspects (Esteves *et al.*, 2002). The answer to the question, whether BPR should follow ERP or ERP should follow BPR, based on survey analysis is also available in the literature. A survey on 220 European companies implementing SAP shows that simultaneous implementation of BPR and SAP is the most effective method for business improvement (*Chemical Marketing Reporter*, 1996).

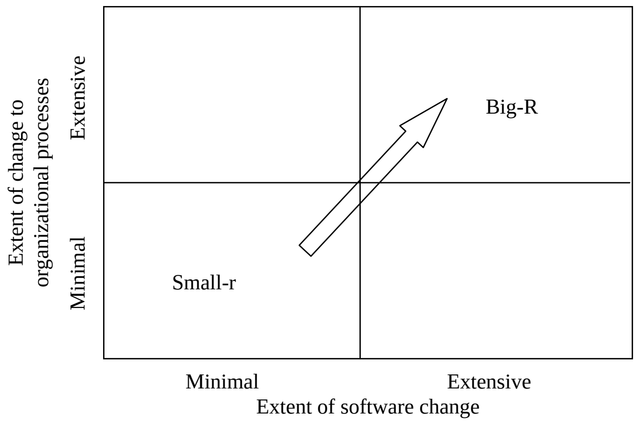
Process improvement efforts can broadly classified under four categories as described below (Kvavik *et al.*, 2002). First, it can be localized process improvement with incremental improvements usually inside one functional department. Second, if the focus is on processes from end-to-end, then it is re-engineering. Some re-engineering efforts are left on paper due to lack of available technologies. Third method is system-enabled process improvement. This can be achieved by redefining end-to-end process using automation and workflow capabilities of the software as well as by redefining the organizational policies and responsibilities. Fourth method is post-system implementation of process improvement. Making the system web-enabled to enhance self-help features and to enable automatic triggering of services in already installed system are simple examples for the same.

8. Gap analysis and re-engineering

Even a custom tailored ERP system meets only 80 percent of the company's functional requirements. Earlier research on BPR in organizations has been found in the literature and the need for the same while implementing ERP is also brought out by earlier literature (Al-Mashari *et al.*, 2001; Al-Mashari, 2003). This gap which exists between company's requirements and the proposed ERP system needs to be analyzed and is termed as gap analysis. Most painful solution is to business process reengineer the business process to suit ERP package. This means changing the established workflow in the company and to tune it line with the workflow given in ERP ware. Though this has the advantage of not undergoing for costly software change process, the same is not possible to be implemented without antagonizing the workers. Usually, what is practiced is as listed below based on a survey by Forrester Research (Lamonica, 1998; O' Leary, 2000):

- choose the application that fits the business and customize little (37 percent);
- customize applications to fit the business (5 percent);
- reengineer business to fit the application (41 percent); and
- no existing policy (17 percent).

Difference between small-r and big-R re-engineering is that in small-r, the organization adapts itself to tight-fitting software. However, with big-R re-engineering, the organization changes both, processes and software to meet its needs. Figure 3 shows the relationship between the extent of organizational process change and the extent of



Source: O' Leary (2000)

Figure 3.
Extent of change in organizational processes vs extent of change in software in ERP implementation

software change in ERP implementation to differentiate big-R re-engineering from small-r re-engineering.

8.1 Small-r re-engineering with minimal organizational process change and minimal software change

Microsoft implemented SAP R/3 making as little change as possible to software. In organizational processes also very little changes took place. This confirms small-r re-engineering. Usually, small-or medium-size firms that do not have enough resources to make the changes in the ERP software implement it in this way. Small-r is also followed by big firms like Microsoft that has wasted lost on previous projects on ERP implementation and lack patience to make the required changes also has resulted in the following method of implementation (Bashein *et al.*, 1997).

Advantages of small-r re-engineering are:

- it is faster and cheaper as it does not require major changes in software or organizational processes; and
- generic processes in this approach are maintained as such and is an ideal option for financial and many back office processes for which the value addition in such processes may not be visible from outside.

Disadvantages of small-r re-engineering are:

- as processes are not changing, number of employees are also not changing; and
- small-r might miss a window of chance for opportunity by not choosing ERP software which demands process changes. SAP R/3 recommends not making changes in the software for small- or medium-sized companies. Advanced business application programs work bench is an integral part of R/3 system for customizing application.

8.2 Extensive process change and minimal software change

Here, the process is changed extensively with little change to software to put the enterprise in the enterprise system (Lamonica, 1998; Bailey, 1999; O'Leary, 2000). It is a chance to change to the best practices in the industry by following the workflow in the ERP software. This method of re-engineering is ideal for firms which believe that changing people is easier and cost effective than changing the software.

Advantages are:

- as software is not changed, it is easier to update using the newer version;
- difficult task of changing ERP software is avoided;
- changing the software means adding a new layer of expertise and labour into the system which is avoided here; and
- chance of process standardization is more as the ERP system constraints the organizational processes to ones available with the ERP system implemented which are standardized and proven.

When all organizational processes conform to the ones available with ERP system, the following disadvantages are:

- value-creating process is changed to generic process. An example is change from incentive scheme to wage scheme to fit the software; and
- organization process changes may not be successful. If the system is decentralized, switching over to common processes may be problematic in all the divisions of the organization.

8.3 Minimal process change and extensive software change

Value-creating processes which are unique to the company are the reason for choosing such a re-engineering approach. Larger companies with enough resources and unique value-creating processes choose this option. It appears better to change software than changing the way large number of people work for a big company. Main difficulty is faced while going for software upgrade after following this approach (Lamonica, 1998; O'Leary, 2000).

The advantage is:

- This is done to accommodate best practices not available with the ERP system implemented. The best example for this re-engineering approach is Nestle which included best practices than what is available in the ERP system implemented.

Disadvantages are:

- Customization makes it difficult to use the software in other divisions of the same company.
- Every software upgrade ends up in extensive software change which drains the resources of the firm.

8.4 Big-R re-engineering extensive organization process change and extensive software change

Boeing is an example for big-R re-engineering while implementing Baan (Busse, 1998; O' Leary, 2000). This re-engineering approach is ideal for cutting edge firms with good market power (O'Leary, 2000). ERP vendors share some risk as they take part in the research and comes out with products which are unique in the ERP solutions market. There are around 18,000 users across four geographical regions and 19 plants with scalability provision to accommodate 50,000 users in the company. Re-engineering was carried out at Boeing in 1998. Materials requirement planning took only 37 minutes instead of days prior to ERP implementation.

Advantages of big-R re-engineering are:

- first, the firm is the first one to enjoy the benefits of the new ERP system generated through big-R; and
- ERP partner shares some of the costs and some part of the risk.

Disadvantages of big-R re-engineering are:

- changing software is an expensive proposition; and
- upgrade is affected which is difficult to implement because of software change.

As we move from quadrant on the left bottom to right top, we are moving from highest success rate to highest failure probability. The choice of the re-engineering method is also dependent on organizational parameters.

9. Next generation ERP systems and business intelligence

Research in intelligent systems and expert database systems (EDS) in particular, has already established many avenues for possible incorporation in ERP systems, far and wide. ERP systems were good at monitoring transactions but many lacked intelligence and analytical ability sufficient enough to prompt the user to streamline the course of action towards more optimal performance. This constrained the application of ERP systems to operational area than planning and strategic areas (Chopra and Meindl, 2001). Integration of ERP and SCM is an important agenda in enterprise systems development. In ERP and advanced planning systems, computer modeling of uncertainties can help decision making, especially in reverse flow management as stated in the reference (Hillegersberg *et al.*, 2001). One of the possible areas where uncertainty handling can improve ERP system functioning is return flows in SCM. Reverse logistics or return flow comprises of products at the end of their life cycle are catching the attention of manufacturers. This has economic as well as social implications as these are manufactured out of rare natural resources many of which are in the verge of depletion. The evolution of ERP system has become a reality as technological advancement has provided vagueness handling capability due to research in artificial intelligence (AI) and the evolution of EDS. Expert systems when coupled with database systems results in EDS which utilizes the knowledge about the functionality of each other very well thus improving the performance of the resulting EDS (Jeffery, 1992). The EDS gives databases ability to perform more intelligently by optimizing query evaluation. Thus, the environment is set ready for re-engineering of ERP systems by providing extensions which can handle uncertainties in the reverse flow to name one possibility. Modern day literature boasts about the power of vertical integration (Margretta, 1998) which can only be made possible to its true sense by the incorporation of AI techniques for handling uncertainty in supply chain. Already researchers have started sowing seeds of newer developments in software, like application of genetic algorithm in inventory models (Mondal and Maiti, 2002). There exists multitude of such possibilities for re-engineering in many modules of the ERP system.

Another example though not directly related to SCM, which involves uncertainty handling, is decision regarding investment in mutual funds for the financial module of the ERP system. Fuzzy logic (Ross, 1995; Yan *et al.*, 1994) when applied to knowledge-based systems is found to model uncertainty well in expert systems.

10. Conclusions

Any development which will bring considerable gain through technology research is well accepted in e-business. BPR is gaining full momentum and its application in true sense is possible only when radical changes can take place in the right direction in a disruptive fashion. This can become possible only through exploiting the recursive relationship between BPR and IT. ERP is the arena for demonstrating the results of the stated recursive relationship. The ways in which BPR is possible while implementing ERP has been presented in this paper. The common problems faced during BPR implementation and their remedial measures are also included in this work. It is found from literature that simultaneous implementation of BPR and ERP is the most effective method in redesigning the business processes. A suitable BPR approach should be selected based on the organizational need and constraints faced by the ERP implementing organization. Appropriate examples from SCM and financial module are presented to show the re-engineering possibilities which are being exploited to bring out the next generation ERP with supply chain integration and more business intelligence.

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