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An Examination of the Role of Organizational Enablers in Business Process Reengineering and the Impact of Information Technology

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ABSTRACT

This study examines organizational factors that affect the implementation of business process reengineering (BPR) when applying two specific Information Technologies (i.e., electronic data interchange and/or Internet technology). This research uses a survey methodology to gather information about how organizational enablers and IT affect BPR implementation. By determining the factors that affect BPR implementation, these factors can be managed in the best interest of customers, employees, and organizations. From the nine hypotheses tested in this study, six factors found to be positively associated with successful implementation of BPR. These factors are: top management supports, change management, centralization of decision making, formalization of procedure, organizational culture, and customer involvement. No significant relationship is found between employee resistance and integration of jobs with successful implementation of BPR. In this research we found that the lack of resources is negatively associated with successful implementation of BPR. We also found that, different information technologies such as those examined in this paper — EDI and Internet — provide different capabilities and can be useful in different ways and for different purposes. The findings of this research can help practitioners to better understand the role of critical success and failure factors in BPR, as well as the impact of different Information Technologies on BPR. By determining the factors that affect BPR implementation, these factors can be managed in the best interest of customers, employees, and organizations.

Keywords: business process reengineering; Information Technology; organizational enablers

INTRODUCTION

The concept of BPR was first introduced by Hammer in 1990. Since initiation it has become a popular management toll for dealing with rapid technological and business change in today's competitive environment. BPR evolved from the experiences of a few US-based companies in the late 1980s (Martinsons & Hempel, 1998). They radically changed their work process by applying modern Information Technology. Report of their dramatically improved performance helped to make reengineering

the American management phenomenon of the early 1990s and its international diffusion.

BPR has been defined and conceptualized in many different ways. The following sample definitions of BPR illustrate the slightly varying views of many researchers and practitioners.

Use the power of modern Information Technology to radically redesign business processes in order to achieve dramatic improvements in performance (Hammer, 1990).

Total transformation of a business; an unconstrained reshaping of all business processes, technologies, and management systems, as well as organizational structure and values, to achieve quantum leaps in performance throughout the business (Goll, 1992).

The process of fundamentally changing the way work is performed in order to achieve radical performance improvements in speed, cost, and quality (CSC Index 1994).

From the practitioner definitions, there are five elements that stand out to form the critical issues that define BPR: (1) BPR consists of radical or at least significant change; (2) BPR's unit of analysis is the business process, not the department or functional area; (3) BPR tries to achieve major goals or dramatic performance improvements; (4) IT is a critical enabler of BPR; and (5) organizational changes are a critical enabler of BPR and must be managed accordingly.

Numerous organizations have reported success from their BPR efforts by containing costs and achieving breakthrough performance in a variety of parameters like delivery times, customer service, and quality. For example, Bell Atlantic reduced the time to install new telecommunication circuits from 15 to three days, and cut labor cost from US$88 to 6 million (Stewart, 1993). Ford Motor reduced its accounts payable staff by 75% with BPR. Motorola, when faced with higher defect percentages and longer cycle times, redesigned its parts and tooling process, simultaneously upgrading its manufacturing equipment; this decreased the total production cost by US$1 billion per year, and cut cycle time by half (Harrison & Pratt, 1993). Other often cited examples of successful BPR programs including AT&T, Eastman Kodak, Hallmark Cards Inc., and IBM Credit, are discussed in some recent works (Aggarawal, 1997; Ascari et al., 1995). However, not all companies that undertake BPR effort achieve their intended results. Hammer and Champy (1993) reveal that as many as 50 to 70% of organizations that make an effort to employ BPR do not achieve the dramatic results they seek. These mixed results make issues of BPR implementation especially important. BPR has great potential for increasing productivity through reduced process time and cost, improved quality, and greater customer satisfaction, but to do so it must be implemented and managed in the best interest of customers, employees, and organizations.

PURPOSE OF THE STUDY

Despite the importance of BPR, research on this subject is not yet firmly established or well structured. Most studies on this subject are either conceptual or case studies. Those case studies usually describe the success of BPR efforts in situations where variables are not defined. Therefore, it is difficult to say what are the critical success and failure factors of BPR. Fur-

thermore the role and impact of IT in BPR in most of the literature is neglected.

This study will propose that successful BPR using Information Technology is related to different organizational enablers. In other words, this study will attempt to identify the managerial and organizational issues and structures (organizational enablers) associated with a successful BPR project using Information Technology (IT enabler). Although there has been some empirical investigation of BPR, no research to date has examined BPR when EDI and Internet technology are used during implementation.

BPR & ORGANIZATIONAL ENABLERS

BPR projects have been evaluated from a number of perspectives in attempting to measure their degree of success. As in any new field, different researchers have identified different factors in BPR success.

Davenport and Short (1990) identify four objectives of BPR. Their set of objective include cost reduction, time reduction, output quality, and quality of work life (QWL)/learning/empowerment.

Morris and Brandon (1993) suggest six basic goals of BPR: (1) streamline the operation; (2) reduce costs; (3) improve quality; (4) increase revenue; (5) improve customer orientation; (6) merge acquired operations.

Stow (1993) reports that the objectives of BPR can be identified as improving an organization's effectiveness, efficiency, competitiveness, and profitability. He especially argues that a reengineering project should be conducted by its objectives and the key to a successful BPR project is defining objectives first.

REVIEW OF BPR SUCCESS FACTORS

There have been numerous studies from different perspectives that identify success factors of BPR. The success factors of BPR can be divided into two groups. One group of factors involves process redesign and the other group of factors is related to change management.

In process redesign, three categories of success factors exist. They are: (1) success factors of process; (2) success factors of project team management; and (3) IT-related factors.

For change management issues, three categories of success factors can be reported. They are: (1) people-oriented factors; (2) managerial/administrative factors; and (3) organizational factors.

Numerous researchers and practitioners believe that top management commitment is the most important factor for a successful BPR effort (Janson, 1993; Davenport, 1993). They argue that BPR never happens bottom up and a reengineered process alone will not change the way people work. Champy and Arnoudse (1992) identify the role, attitude, vision, and skill or knowledge of leaders as necessary for the successful BPR. Especially, they state that BPR must be more top-down driven than a quality improvement plan because of its radical change requirement. Since BPR focuses on processes that are inherently cross-functional, leadership by those who have comprehensive perspectives and the authority to coordinate different interest groups is essential.

Hammer and Champy (1993) also emphasize the importance of measurement and rewards for reengineered process performance. They argue that paying employees based on their position is inconsistent

with the principles of BPR. They must be paid based on their performance and ability. Measuring the performance of a process and people is important for evaluating BPR, but the way of measuring is sometimes inadequate. To get employees to operate productively in teams, share information, take initiative, and display other behaviors that are now important, top management must devise new rewards and management processes.

Bashein and her associates (1994) suggest more concrete factors of successful BPR projects. They argue that sound financial condition, an appropriate number of BPR projects under way, and IS and human resource specialists involvement are critical to BPR success.

Clear, honest, and frequent communication is also important for successful BPR implementation. Sharing information and empathizing with employee concerns can help minimize resistance (Janson, 1993).

Katzenbach and Smith (1993) propose that it is important for a BPR project team to have people from different interest groups. They identified that the size of a BPR project team, its members' level of skill, a shared goal, and mutual accountability among team members are important factors for successful project team management.

Stow (1993) argues that BPR efforts must be conducted by objectives. Defining objectives establishes a road map for the BPR efforts, and BPR objectives must be selected based on company strategy and vision.

Davenport and Short (1990) identify that selecting right processes for BPR is an important success factor. Although total redesign is the ultimate objective, companies should select a few key processes for their initial efforts. They suggest two approaches to selecting processes for BPR. The exhaustive approach attempts to identify all processes within a company and then prioritize them in order of redesign urgency. The "big-impact" approach attempts to identify only the most important processes or those most in conflict with the business vision and process objective.

Harrison and Partt (1993) state that providing the baseline and benchmark of the existing business process, constructing the vision of the future process, and designing the improvement are other important factors of process redesign.

Rosen and Stanton (1992) propose that project duration is another important success factor of BPR. The carefully reengineered process and its supporting infrastructure might be obsolete if a project takes too much time. To avoid this outcome, they suggest a method of process design that consists of decomposition, integration, and validation of processes (Rosen & Stanton, 1992).

REVIEW OF BPR FAILURE FACTORS

In almost every case, BPR brings about major changes in organizations that make them more competitive and more responsive to the market. However, its implementation is never easy. According to the 1991 report of CSC Consulting, one quarter of nearly 300 North American companies involved in BPR reported that they were not meeting their goals (Stanton et al., 1992). Hammer and Champy report that more than 75% of BPR projects have been unsuccessful. One reason for the high failure rate is the scope of BPR: It often involves large numbers of people and may extend over a period of years. Another reason is that it always demands radically new behaviors, and that can provoke strong re-

sistance within organizations (Janson, 1993). The following are major reasons for BPR failure.

Resistance to Change

The primary reason for BPR failure is resistance from key persons who would be affected by a BPR effort (Stanton et al., 1992). By giving employees the tools and expertise to take on multiple tasks, BPR breaks down the long-standing walls that separate departments and functional units. Managers may lose their power as a result of BPR since it flattens management layers, shifts responsibility, and disrupts the status quo. Therefore, resistance by managers generally is caused by altered status, job security, and loss of control and position (Davenport, 1993; Hammer & Champ, 1993; Stanton et al., 1992).

Others may be afraid of losing their job since BPR eliminates unnecessary jobs and tasks. Resistance by workers is also caused by the team-oriented approach, lack of ability to be adjusted to new technologies and process, and vested interests and territorial disputes.

Other sources of resistance are fear and skepticism about BPR results. Feeling discomfort is another important source of resistance. Since a reengineered process often requires skills for operating advanced IT, some people may feel discomfort (Davenport, 1993). Thus, failure to accommodate those key persons influenced by BPR can cause failure.

A functional unit's parochial interests are another barrier to successful BPR projects. When a BPR project does not have top management commitment or it is initiated from the bottom-up, the BPR effort can be stymied by functional managers defending their parochial interests (Stanton et al., 1992). Since BPR focuses on processes that are inherently cross-functional, leadership by those who have a comprehensive perspective and the authority to coordinate different interest groups is essential for a successful BPR effort.

Lack of Resources

A company that is financially unhealthy is unlikely to succeed at BPR effort. A company may have too many disparate businesses or be too leveraged to be able to commit the significant financial resources required by BPR (Bashein et al., 1994). A company that lacks competent technical/managerial skill is unlikely to succeed. A BPR project requires technical as well as managerial skill to redesign and implement the reengineered process (Johansson et al., 1993).

Unrealistic Expectations

Misconceptions and misunderstandings about BPR are allegedly common among stakeholders (Hall et al., 1993). Top management expectations may not be realistic. They may want concrete evidence of success within a few months, when the design and implementation of a project may take more than a year. If misconceptions and unrealistic expectations exist among stakeholders, attracting their commitment throughout the project duration is impossible. Without their commitment, a BPR project can hardly be successfully conducted.

Too Many Improvement Projects Under Way

BPR may be viewed as just another program in an organization with too many improvement projects already under way. Diverse projects may be poorly planned,

badly integrated, and mutually self-defeating. When multiple projects are undertaken at the same time, their effectiveness may be diluted. Too many projects may compete for scarce organization resources such as human, technical, and financial resources. Management commitment may not be sustained throughout the project duration.

Narrowly Defined Process

Many BPR efforts fail because of insufficient process breadth. Hall and her associates (1993) state that narrowly defined process redesign may cause BPR failure since redesigned processes cannot mesh with related processes. As a result of a carefully redesigned process, a company can achieve dramatic improvements within individual processes, only to watch overall performance decline. They propose that the process to be redesigned must be broadly defined in terms of cost or customer value in order to improve performance across the entire business unit. However, other BPR efforts fail because of a too broad, indiscriminate approach.

Incomplete Restructuring of an Organization

The successful BPR effort requires a complete restructuring of the key drivers of organizational behavior (Hall et al., 1993). They propose that six key drivers of organizational behavior — roles and responsibility, measurements and incentives, organizational structure, IT, shared value, and skills — have to change as a result of BPR. Their investigation of BPR cases find that companies that manipulate all six-depth levers to bring about behavioral change show the most dramatic process cost reduction.

BPR & IT ENABLERS

IT plays an enabling role in BPR. An enabler is an agent that allows organizations to break their old rules and create new reengineered processes (Hammer & Champy, 1993). IT should be considered as more than an automating or augmenting force. It can fundamentally reshape, or enable, the way business processes are done. IT can include any enabling technology that an organization uses to support its business. This includes its systems for manufacturing, information management, control, measurement, design, and engineering. IT obviously has great potential, but it is difficult to use effectively. BPR addresses these difficulties by directly designing the effective use of IT into reengineered business processes. Although IT is not the solution, the use of IT to improve processes is essential in BPR projects. During BPR's examination of existing business processes, new and improved uses of IT are often discovered. It is BPR that can relate the use of IT directly to business processes.

In addition to enabling productivity improvement, IT can also enable radical alterations of the cost structure of jobs. However, to actually change jobs takes a combination of management leadership and employee participation. IT is also an enabler of social and organizational transformation, making it an integral part of an organization's strategy (Parker, 1996).

Some categories of information technologies that are commonly used in BPR programs are as follow:

- Databases and related technologies.
- Networking and communication.
- Electronic data interchange (EDI).
- Workflow automation and GroupWare.
- Internet web-based technology.

- Enterprise system and enterprise resource planning (ERP).
- Multimedia and interactive computing.

Of course, this list is neither exhaustive nor mutually exclusive. However, a firm needs to make independent decisions about each (Ranganathan & Dhaliwal, 2001).

IT enables BPR by providing tools necessary to analyze, communicate, and redesign business processes. IT in this study refers specifically to Electronic Data Interchange and Internet technology. Different information technologies provide different capabilities and can be useful in different ways.

EDI AS AN IT ENABLER

The idea of doing business in the networks developed in the 1960s when Electronic Data Interchange (EDI) and Electronic Fund Transfer (EFT) were first introduced to banks and financial institutions and gradually expanded to many other applications for exchanging data among private networks (Ahadi, 2002).

The United Nations Electronic Data Interchange for Administration, Commerce, and Transportation (UN/EDIFACT) define EDI as interchange of standard formatted data between computer application systems of trading partners with minimal manual intervention (Kalakota & Whinston, 1996).

EDI is a rapidly growing technology. The number of registered EDI users, according to EDI Yellow Pages International, has shown impressive gains in the past several years, well in excess of a 50% annual growth rate (Lim & Palvia, 2001).

Of course, routine communications over the Internet are widely accepted, and even EDI over the Internet is increasing because of its lower costs. However, issues of security, accuracy, and the size of files may hold up Internet usage for production and business transactions (Brunell, 2000).

EDI enables BPR through faster processing speed, greater accuracy, reduced costs, competitive advantages, improved operation, security, tracking and control, intra- and inter-company communications, and customer service (Lim & Palvia, 2001).

INTERNET AS AN IT ENABLER

Internet is the most recent Information Technology used in BPR. The Internet can be used as an IT enabler by allowing organizations to create easily accessible communication networks (Parker, 1996).

Internet technology enables BPR projects through three benefits: (1) cost; (2) availability; and (3) compatibility. The cost benefit of Internet technology includes the cost of Internet technology itself as well as cost savings incurred through its use.

Internet technology has saved costs by allowing faster and easier access to more accurate company information.

Internet technology enables BPR through the availability of the technology itself, as well as making information more easily and quickly available. Productivity increases from Internet technology arising from more rapid and easier exchange of information. Internet technology allows both structured and unstructured information to be easily accessed from data storage throughout an organization. Cross-functional teams can proactively share information about issues such as: (1) employee policies; (2) daily announcements; (3) company mission and objectives; and (4) project information.

For example, Ford Motor Company used Internet technology to facilitate the global exchange of information to create 24-hours-a-day, seven-days-a-week orga-

nizational productivity. Design centers in Asia, Europe, and the US were connected through Internet technology to engineer the 1996 Ford Taurus (McGrath & Schneider, 1997).

METHODOLOGY & HYPOTHESES GENERATION

Through review of the literature, four groups of factors that are critical to BPR implementation were identified. They are: (1) management commitment; (2) organizational culture; (3) organizational structure; and (4) customers. These groups of factors can be further divided as depicted in Figure 1. To examine the role of organizational enablers to BPR, nine hypotheses were generated.

Related questions to each factor were addressed in our survey questionnaire to measure the extent of these factors for a successful implementation of BPR.

Top Management Support

Top management support is an important ingredient of an innovative organizational environment (Van De Ven, 1986). Top management represents decision makers, visionary leaders, political actors , and teachers (Smith et al., 1995). Top management support must be obtained and sustained to successfully implement BPR.

We designed appropriate questions in our survey questionnaire to measure the extent of top management support for successfully implementing the reengineered process. Therefore we developed the related hypothesis:

H1: Top management support is positively associated with successful implementation of BPR.

Change Management

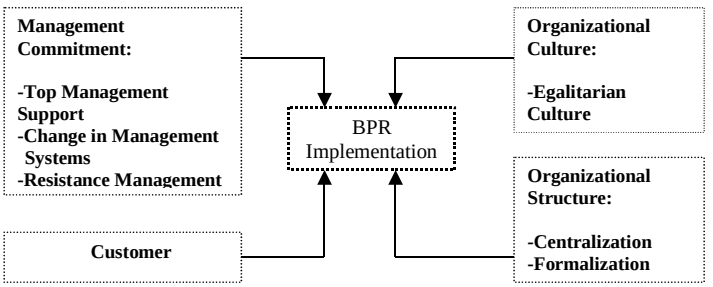
Another essential element of developing an innovative organizational environment for successful BPR implementation is change management (Hammer, 1990). Change management commitment includes: (1) employee empowerment; (2) performance measurement; (3) reward systems; (4) training and education; (5) communication; and (6) organizational structure (Hall et al., 1993). We developed the second hypothesis:

H2: Effective change management is positively associated with successful implementation of BPR.

Employee Resistance

Employee resistance can prevent BPR projects from succeeding. Employee resistance can be caused by: (1) the dan-

Figure 1: Factors Affecting BPR Implementation



ger of losing job security (Hammer & Stanton, 1994; Venkatraman, 1994); (2) loss of power (Hammer & Stanton, 1994); (3) skill or knowledge requirement (Morris & Brandon, 1993); (4) skepticism about results (Hammer & Stanton, 1994); (5) functional unit's interests (Hall et al., 1993; Hammer & Stanton, 1994); and (6) resistance of customers (Hammer & Stanton, 1994; Venkatraman, 1994).

H3: Employee resistance is negatively associated with successful implementation of BPR.

Lack of Resource

Organizations use resource management to develop an innovative organizational environment for successful BPR implementation. A lack of resources can prevent BPR projects from succeeding (Bashein et al., 1994; Venkatraman, 1994). Resource management involves the following four resources: (1) financial (Marchand & Stanford, 1995; Johansson et al., 1993); (2) technical (Davenport & Short, 1990; Marchand & Stanford, 1995; Parker, 1996); (3) human (Marchand & Stanford, 1995; Smith & Willcocks, 1995); and (4) time (Marchand & Stanford, 1995; Smith & Willcocks, 1995).

H4: Lack of resources is negatively associated with successful implementation of BPR.

Centralization of Decision Making

Centralization of decision making involves the degree of participation of employees in the organization in the decision-making process. In centralized organizations, most of the important decisions are made by upper-level management. Researchers have found that centralized decision making is positively associated with creating an innovative organizational environment (Beyer & Trice, 1978). In decentralized organizations, lower-level employees are allowed to make many decisions. Researchers have also found that decentralized decision making is positively associated with creating an innovative organizational environment (Moch & Morse, 1977). One reason for conflicting findings is that innovation is promoted from the top down during the initialization phase of a BPR project, and from the bottom up during the implementation of a BPR project (Zaltman, 1973). Even though research findings may be conflicting, it is generally thought that centralized decision making reduces input from multiple sources. Thus, a strong initiative and drive for BPR implementation can be possible. On the other hand, this reduction of input hinders the creation of an innovative organizational environment (Zaltman, 1973). Therefore, this study will hypothesize that centralization of decision making has a negative impact on BPR implementation.

H5: Centralization of decision making is negatively associated with successful implementation of BPR.

Integration of Jobs

Job integration attempts to incorporate work into a process to more effectively manage a complete business. The integration of jobs is used to design work that is performed along process lines rather than functional lines. Most BPR projects cross functional or department lines in an organization (Hammer & Champy, 1993; Grover et al., 1995; Scheer, 1998). Thus, job integration is a common characteristic of a reengineered process. However, there

can be negative consequences to job integration. Employees may develop lower job satisfaction or deterioration in the quality of their work life. The relationship between job integration and BPR is still unclear.

H6: Integration of jobs is positively associated with successful implementation of BPR.

Formalization of Procedures

Formalization of procedures is the extent to which job responsibilities are expressed in written rules and regulations, and employees are evaluated based on the written procedures (Beyer & Trice, 1978). A formalized organization has a comprehensive set of written rules and regulations developed to handle decision making and business processes. It was found that the degree of formalization was negatively associated with the adoption and implementation of innovations in organizations.

H7: Formalization of procedures is negatively associated with successful implementation of BPR.

Egalitarian Culture

Organizational culture is an important factor in developing an innovative organizational environment for successful BPR implementation. Cooperation, coordination, and empowerment of employees are the standard characteristics of an innovative organizational environment. Egalitarian culture supports these attitudes. Egalitarian culture is characterized by: (1) shared organizational vision and information; (2) open communication; (3) strong leadership style; and (4) employee participation in decision making (Grover et al., 1995).

H8: An egalitarian culture is positively associated with successful implementation of BPR.

Customer Involvement

An innovative organizational environment requires customer involvement during BPR (Zirger & Maidique, 1990). Customer involvement includes: (1) customers being involved throughout the BPR project; (2) information gathered from customers drives the BPR project; (3) the BPR project satisfies customers' needs; and (4) gathering requirements from customers before the BPR project begins.

H9: Customer involvement is positively associated with successful implementation of BPR.

SUCCESS

In addition to the variables discussed above, BPR implementation success was measured over the six dimensions:(1) process time reduction; (2) process cost reduction; (3) user learning; (4) output quality; (5) quality of work life; and (6) responsiveness to customer needs (Morris & Brandon, 1993; Davenport, 1993).

DATA COLLECTION

The exploratory nature of the research lends itself to using informants and respondents to gather information. The questionnaire was prepared using information gleaned from prior literature in the area. It was pilot tested with three faculty members in Management Information Systems and a consulting firm specialist in BPR. Based on their feedback, appropriate changes were made to the question-

naire. We chose two methods of soliciting respondents: Web based and paper based.

1. In November 2001, our finalized questionnaires were transmitted via email to 190 selected companies for two specific industries: automotive parts and electronics.
2. In January 2002, finalized questionnaires were distributed to 155 selected companies attending the First International Conference on intellectual property and e-business. This event was used to examine the benefits offered by the convergence of major industries engaged with Information Technology.

A total of 345 questionnaires were distributed, 77 were returned, for a response rate of 22%. Five of the returned questionnaires were deemed invalid because too many values were missing or incomplete. Thus 72 companies are examined in this study. The demographics of respondent organizations are shown in Figures 2 through 5.

STATISTICAL ANALYSIS

As the first step of measurement validation, the reliability of collected data was examined using Cronbach's coefficient alpha. The Cronbach's alpha value is 0.7417, which is relatively high, and falls within the acceptable range. The Pearson correlation coefficient was chosen to reveal the magnitude and direction of the hypothesized relationships. T-tests with alpha levels set at 0.05 were used to determine significance of the Pearson correlation coefficients. In information systems research, it is common for correlation coefficients of 0.20 and above to be considered meaningful when using correlation analysis in an exploratory study (Griffith & Northcraft, 1996).

Finding

The collected data revealed that 74% (53 firms) of our respondent firms had completed some BPR projects in the past 18 months and 26% (19 firms) had some BPR projects currently under implementation. All of the BPR projects in this research used either EDI or Internet technology. Any

Figure 2: Participating Organizations

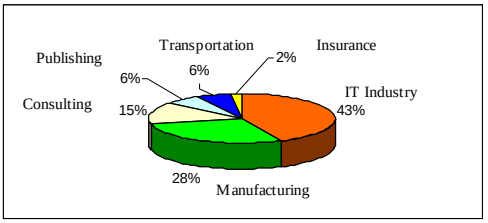


Figure 3: Sample Demographics Revenue US$

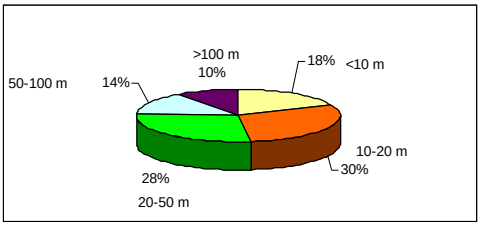


Figure 4: BPR Implementation Statistics

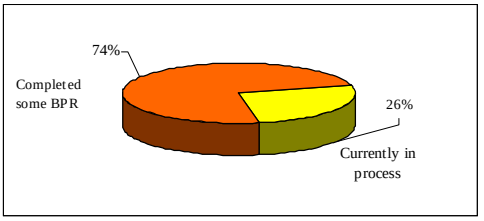


Figure 5: Type of IT used in BPR Projects

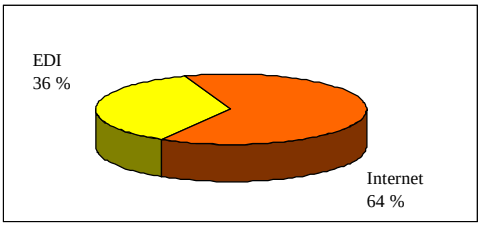


Table 1: Summary of Correlation Analysis

Hypotheses	Variable	Correlation Coefficient	T-test value	Result
H1	Top Management Support	0.680	.0000	Accepted
H2	Change Management	0.708	.0000	Accepted
H3	Employee Resistance	0.186	.117	Rejected
H4	Lack of Resources	- 0.522	.0000	Accepted
H5	Centralization of Decision Making	0.480	.0000	Rejected
H6	Integration of Jobs	0.079	.508	Rejected
H7	Formalization of Procedures	0.530	.0000	Rejected
H8	Egalitarian Culture	0.437	.0000	Accepted
H9	Customer Involvement	0.451	.0000	Accepted

questionnaires returned that did not use EDI or Internet technology were not included in the analysis. As depicted in Figure 5, 64% of our respondent firms cited the Internet as an IT enabler for their BPR efforts.

There are two basic approaches to BPR (Klein, 1994). One group of researchers relies on an intuitive approach. They believe that too much attention to current practices gets in the way of innovative thinking. Hammer and Champy belong to this group.

The other group of researchers and practitioners, so-called Methodists, believe that a structured methodology is a good way of facilitating training, providing checkpoints for an ongoing project, and building expertise on different aspects of BPR. Davenport, Short, Harrison, Pratt, and Johansson belong to this group.

In this study, 75% of the participant organizations sought some type of expertise from external consultants. From the high percentage of organizations that reported using some type of methodology, it seems obvious that organizations have seen the benefits of utilizing a BPR methodology when using either EDI or the Internet to reengineer processes.

EDI VS. INTERNET

We tried to assess the functional areas that have been targeted for BPR efforts by participant organizations. The statistics are presented in Table 2. From Table 2 it is evident that participant organizations have essentially focused on their customer service followed by order management, inventory management, and purchasing management for either EDI or Internet application. Our results are different from the results of the CSC/Index survey, which reported that Accounting and Finance were the functions reengineered by most North American companies, followed by Marketing and Sales. We also found that the frequency of selected Information Technology is different within the selected process for reengineering. For example human resources management, new product development, and marketing management ranks 5,6,7 for Internet application and ranks 10,13,12 for EDI application to BPR, respectively.

BPR programs may be undertaken for a variety of reasons. Our survey indicated significant difference among the objectives for BPR, when two different Information Technologies — EDI or Internet — were applied to BPR. Easier access to information, electronic commerce, and Cost reduction are the main motives for undertaking BPR by applying Internet technology. Efficient connection of organizational resources, exchange of information, and increase of productivity seem to be the most important reasons for applying EDI to

Table 2: Comparison of Selected Process for Reengineering by Using EDI or Internet Technology

Type of Business	Rank in Internet	Rank in EDI
Customer service	1	1
Order management	2	2
Inventory management	3	3
Purchasing	4	4
Human resources	5	7
New product development	6	10
Marketing	7	13
Research & development	8	12
Sales	9	15
Production	10	14
Receiving	11	16
Shipping	12	17
Billing	13	6
Invoicing	14	5
Accounts receivable	15	8

Table 3: Comparison of Reasons for Using EDI or Internet Technology for BPR

Reasons for Using Internet or EDI	Rank in Internet	Rank in EDI
Easier access to info	1	15
E-commerce	2	6
Cost reduction	3	7
Reduce geographic distance	4	17
Faster processing speed	5	8
Reduce administration	6	4
Reduce distribution costs	7	12
Easily accessible communication network	8	14
Faster access to info	9	13
Reduce paper flow	10	11
Access to more accurate info	11	9
Communication between employees	12	16
Global exchange of info	13	18
Increase productivity	14	3
Efficient connection of organizational resources	15	1
Exchange info	16	2

BPR. The results of our survey support the CSC/Index survey of North American firms in which cost cutting was ranked as the second most important objective, next to improving the speed of business processes.

Another survey of 80 American corporations identified cost cutting as a major goal for BPR programs (Maglitta, 1995). A study of European organizations also found that BPR projects in Europe are mostly concerned with saving of cost and time (Coulson & Colin, 1997). As it is indicated in the Table 3, there is a different relationship between selected Information Technology — EDI or Internet — with the objectives of BPR. For example for objectives such as easier access to information, electronic commerce, and cost reduction, it seems that Internet technology is the preferred IT for reengineering than EDI, ranks 1,2,3, compared to 1,5,6,7. For objectives such as efficient connection of organizational resources, exchange information, and increase productivity, EDI ranks 1,2,3, and

Table 4: ANOVA — Perceived Success of BPR Across Different Kinds of Organizations

Participant Organizations	Mean	S.D.	F-value
IT Industries	3.65	0.29	13.2
Manufacturing	3.34	0.19	
Consulting	3.32	0.26	

Table 5: ANOVA — Perceived Success of BPR Across Different Kinds of Information Technology

Selected Technology	Mean	S.D.	F-value
EDI	3.25	0.45	8.97
Internet	3.55	0.37	

Internet application ranks 15,16,14 respectively.

SUCCESS OF BPR EFFORTS

We tried to assess BPR efforts from different perspectives. A series of Analysis of Variance was performed to further investigate the responses by the participant organization to the selected variables.

Perceived Success of BPR Across Different Kinds of Organizations

We performed ANOVA to investigate the perceived success scores across three main participant organizations including: IT-related business, manufacturing, and consulting firms. It was found that the mean scores were significantly different across different organization types (F-value = 13.2, $P < 0.05$).

While the mean for perceived success score was lowest among the consulting firms, it was highest among the IT industries. See Table 4 for more statistics.

Perceived Success of BPR Between EDI & Internet Application

We performed ANOVA to see if there are any significant differences among the perceived success scores across selected technologies for BPR. It was found that the mean scores were significantly different between EDI and Internet application with mean scores of 3.25 for EDI and 3.55 for Internet (F-value = 8.97, $P < 0.05$). The results are presented in Table 5.

Perceived Success of BPR Across Different Kinds of Methodology

ANOVA was performed to investigate the perceived success scores across three main methodologies that are commonly use in BPR programs. These are; outside consulting methodology, internal methodology, and joint methodology (internal and external). It was found that the mean scores were significantly different across different kinds of methodologies (F-value = 6.84, $P < 0.05$).

While the mean for perceived success score was lowest among the organizations using their own methodology, it was highest among the organizations using a joint methodology with conjunction of internal and external expertise. The detailed statistics are tested in Table 6.

PROBLEMS IN BPR

Through review of the literature (Clemons et al., 1995; Grover et al., 1995, 1998; Hammer & Champy, 1993) we compiled a list of four main problems commonly

Table 6: ANOVA — Perceived Success of BPR Across Different Kinds of Methodology

Participant Organizations	Mean	S.D.	F-value
External methodology	3.52	0.27	6.84
Internal methodology	3.33	0.17	
Joint methodology	3.69	0.23	

Table 7: ANOVA — Problems in BPR Across Different Kinds of Organizations

Problems in BPR	Mean			S.D.			F-value
	I	M	C	I	M	C	
Financial Problems	3.54	3.52	3.36	0.29	0.32	0.32	1.45
Technical abilities	3.32	3.70	3.46	0.20	0.28	0.33	12.80
Human resources	3.34	3.69	3.70	0.21	0.23	0.33	15.81
Time schedule	3.54	3.48	3.40	0.29	0.33	0.32	0.85

encountered in BPR efforts and included in our questionnaire. The severity of the problems was again measured on a Likert scale of 1 to 5. Financial problems, technical ability, human resources, and time limitation are the greatest problems when firms engage in BPR. In order to determine whether there were any significant differences in the severity of problems in BPR efforts among three main participant organizations, ANOVA test was performed. Two of the four problems, including human resources and technical ability, were significantly different among different organizations. The results are presented in Table 7.

DISCUSSION & CONCLUSION

This research used nine hypotheses to investigate the relationship between managerial and organizational factors, and successful BPR implementation using EDI or Internet technology. Although all hypotheses were not accepted, recommendations can be made from the accepted and rejected hypotheses as well as comparison results of selected technology for BPR. The following is a discussion of the recommendations to organizations based on this research's findings.

The BPR project should be conducted using a specific BPR methodology that is strictly adhered to and well documented from the beginning to the end of the process. Procedures for the new process should also be specifically defined and quantitatively measured. When properly constructed, a BPR methodology is designed to steer the reengineering of business processes toward success. This allows a BPR methodology to guide analytic thinking without bias towards one right answer or implementing a rigid set of rules that must be followed in an inflexible order. Without a methodology, BPR projects can flounder and be unsuccessful. According to our finding, from 72 participant organizations in this research, only two respondents reported not using any type of BPR methodology. From the high percentage of organizations that reported using some type of methodology, it seems obvious that organizations have seen the benefits of utilizing a BPR methodology when using either EDI or Internet technology to BPR.

Despite popularity of BPR, many organizations lack experience in conducting BPR projects. To relax this problem, outside consultants can be used to provide expertise to BPR projects. However, consultants may lack the business expertise

needed to develop a new cross-functional process for a specific organization. A good solution for utilizing outside BPR expertise is conjunction and collaboration of in-house expertise with outside BPR consultants for additional assistance.

The finding of this study supports the joint collaboration of internal and external expertise for BPR efforts. We found that the mean for perceived success score was highest among the organizations using a joint methodology for BPR, while it was lowest among the organizations using their own methodology without assistance of external expertise.

One of the first issues a BPR project should address is obtaining top management's support. Top management should serve as the BPR project's champion from the beginning all the way through the project's implementation. This champion should be well informed about the BPR project's objectives and its potential effects on the organization. This allows the champion to effectively communicate with employees affected by the BPR project. Most of the important decisions about the BPR should be made by the top management and the BPR project team. Therefore top management support must be obtained and sustained to successfully implement BPR.

We found a positive and strong correlation between egalitarian culture and centralization of decision making with successful implementation of BPR. Organizational culture is an important factor in developing an innovative organizational environment for successful BPR implementation. Cooperation, coordination, and empowerment of employees are the standard characteristics of an innovative organizational environment. Therefore open communication with strong leadership should be encouraged during the BPR project.

Customers of the BPR project should be involved throughout the BPR methodology's analysis, design, and implementation phases. The satisfaction of their requirements and needs should be one of the primary goals of the BPR project.

It is important for organizations to create an innovative environment to increase the chances of successfully implementing a BPR project that uses Information Technology. In order to do so, organizations must use a strong leadership style to create an environment where employees affected by the BPR project understand its objectives and are involved throughout the BPR process.

Radical changes may occur as a result of BPR and must be understood by all affected employees. Training and reward programs should be implemented to assist employees during their transition. These initiatives are easily implemented especially when applying Internet technology, because employees find Internet technology easy to work with and do not feel threatened by the technology.

This research found that financial problems, technical ability, human resources, and time limitation are the greatest problems when firms engage in BPR. It also found that two of the four problems, including human resources and technical ability, were significantly different among different organizations. Understanding the expected problems and severity of them can help organizations to face these problems properly and increase the possibility of a successful implementation of BPR.

In this study we found significant differences between selected Information Technology for BPR. We found that perceived success score for participant organizations that applied Internet technology for BPR is significantly higher than those

applying EDI (3.55 vs. 3.25). This higher success result is perhaps due to ease of use of Internet technology. We also found significant differences across different kinds of organizations when applying Information Technology for their BPR programs. For instance 3.65, 3.34, and 3.32 for IT industries, manufacturing, and consulting companies respectively. Lack of attention to these relationships may be one reason for unacceptably high implementation failure rate in the previous BPR efforts.

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