BPR implementation process: an analysis of key success and failure factors

Majed Al-Mashari and Mohamed Zairi
Bradford University Management Centre, Bradford, UK

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Abstract *This paper provides a holistic view of the Business Process Re-engineering (BPR) implementation process. It reviews the literature relating to the hard and soft factors that cause success and failure for BPR implementation, classifies these factors into subgroups, and identifies key factors of success and failure. Finally, it explains how these factors influence the process of BPR implementation.*

Introduction

Following the publication of the fundamental concepts of BPR by Hammer (1990) and Davenport and Short (1990), many organisations have reported dramatic benefits gained from the successful implementation of BPR. Companies like Ford Motor Co., CIGNA, and Wal-Mart are all recognised as having successfully implemented BPR.

However, despite the significant growth of the BPR concept, not all organisations embarking on BPR projects achieve their intended result. Hammer and Champy (1993) estimate that as many as 70 percent do not achieve the dramatic results they seek. Having BPR repeatedly at the top of the list of management issues in annual surveys of critical information systems reflects executives' failure to either implement properly or acquire the benefits of BPR (Alter, 1994). This mixture of results makes the issue of BPR implementation very important. BPR has great potential for increasing productivity through reduced process time and cost, improved quality, and greater customer satisfaction, but it often requires a fundamental organisational change. As a result, the implementation process is complex, and needs to be checked against several success/failure factors to ensure successful implementation, as well as to avoid implementation pitfalls.

The following analyses the BPR implementation process by reviewing the relevant literature on both soft and hard factors that cause success and failure of BPR efforts. The factors listed below are distilled from various articles and empirical research on BPR implementation. They were then categorised into a number of subgroups representing various dimensions of change related to BPR implementation. These dimensions are:

(1) change management;

(2) management competency and support;

(3) organisational structure;

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(4) project planning and management; and

(5) IT infrastructure.

BPR success factors

Factors relating to change management systems and culture

Change management, which involves all human- and social-related changes and cultural adjustment techniques needed by management to facilitate the insertion of newly-designed processes and structures into working practice and to deal effectively with resistance (Carr, 1993), is considered by many researchers to be a crucial component of any BPR efforts (Talwar, 1993; Moad, 1993; Zairi and Sinclair, 1995; Towers, 1996; Cooper and Markus, 1995; Hammer and Stanton, 1995; Bashein *et al.,* 1994; Carr and Johanson, 1995; Bruss and Roos, 1993; Janson, 1992; Kennedy, 1994). Revision of reward systems, communication, empowerment, people involvement, training and education, creating a culture for change, and stimulating receptivity of the organisation to change are the most important factors related to change management and culture.

Revising reward and motivation systems

Staff motivation through a reward programme has a crucial role in facilitating re-engineering efforts and smoothing the insertion of new processes in the workplace (Towers, 1994; Bjørn-Andersen and Turner, 1994; Hinterhuber, 1995; Ostroff and Smith, 1992; Dawe, 1996; Feltes and Karuppan, 1995). As BPR brings about different jobs (*The Trouble with Reengineering*, 1995), existing reward systems are no longer appropriate for the new work environment (Hammer and Champy, 1993; Harvey, 1995; Davenport and Nohria, 1994). Therefore, reward systems should be revised as part of the BPR effort (Jackson, 1997) and the new reward and incentive system must be widespread, fair and encourage harmony among employees (Towers, 1994). Introducing new job titles can be considered as one example of encouraging people to endorse the re-engineering programme without fear (*The Trouble with Reengineering*, 1995).

Effective communication

Effective communication is considered a major key to successful BPR-related change efforts (Davenport, 1993; Jackson, 1997; Zairi and Sinclair, 1995; Hammer and Stanton, 1995; Carr and Johansson, 1995; Arendt *et al.*, 1995; Dawe, 1996). Communication is needed throughout the change process at all levels and for all audiences (Davenport, 1993a), even with those not involved directly in the re-engineering project (Dixon *et al.,* 1994). Effective communication between stakeholders inside and outside the organisation is necessary to market a BPR programme (Talwar, 1993; Hinterhuber, 1995) and to ensure patience and understanding of the structural and cultural changes needed (Berrington et al., 1995) as well as the organisation's competitive situation (Cooper and Markus, 1995). Communication should take place

frequently (Davenport, 1993, Carr, 1993; Janson, 1992) and in both directions between those in charge of the change initiatives and those affected by them (Davenport, 1993a; Jackson, 1997; Grugle, 1994; Talwar, 1993). Communication should be open, honest, and clear (Davenport, 1993; Janson, 1992), especially when discussing sensitive issues related to change such as personnel reductions (Davenport, 1993).

Empowerment

As BPR results in decisions being pushed down to lower levels, empowerment of both individuals and teams becomes a critical factor for successful BPR efforts (Thomas, 1994; Cooper and Markus, 1995; Bashein *et al.,* 1994; Hinterhuber, 1995; Dawe, 1996) since it establishes a culture in which staff at all levels feel more responsible and accountable (Rohm, 1992/93) and it promotes a self-management and collaborative teamwork culture (Mumford, 1995). Empowerment entails that staff are given the chance to participate in the redesign process (Bashein *et al.,* 1994). When empowered, employees are able to set their goals and monitor their own performance as well as identify and solve problems that affect their work, thus they are supporting the BPR efforts.

Human involvement

In re-engineering, all people must be openly and actively involved (Berrington and Oblich, 1995; Jackson, 1997; Bashein *et al.*, 1994; Hinterhuber, 1995; Bruss and Roos, 1993; Arendt *et al.,* 1995; Dawe, 1996) and should be consulted at all stages on the process and its leaders. This includes line managers (Harrison and Pratt, 1993), process owners (Furey, 1993), those involved in IS and human resources (Bashein *et al.,* 1994), and workers (Janson, 1992). The culture of experimentation is an essential part of a successfully re-engineered organisation and, therefore, people involved or affected by BPR must be prepared to endure errors and mistakes while re-engineering is taking place.

Training and education

Many researchers consider training and education to be an important component of successful BPR implementation (Towers, 1994; Berrington and Oblich, 1995; Zairi and Sinclair, 1995; Worsley, 1994; Bashein *et al.*, 1994; Clemmer, 1994; Cooper and Markus, 1995; Arendt *et al.,* 1995; Dawe, 1996). Organisations that undertake re-engineering projects may have to increase their training budget by 30-50 percent (Towers, 1994). BPR-related concept, skills, and techniques (Cooper and Markus, 1995; Berrington and Oblich, 1995; Worsley, 1994) as well as interpersonal and IT skills (Towers, 1994), skills in TQM implementation and process analysis techniques (Dixon *et al.*, 1994), are all important dimensions of training for BPR. It is also important to educate people in IT-related innovations for competitive advantage, the potential of IT in reshaping the business and the leadership of empowered organisations (Bruss and Roos, 1993). Business managers, line managers, IS managers, and other staff in the front-line are the people who benefit most from education and

training activities (Towers, 1994) in both business and IT-related skills and expertise.

Creating an effective culture for organisational change

Organisational culture is a determining factor in successful BPR implementation (Hammer and Champy, 1993; Davenport, 1993; Zairi and Sinclair, 1995; CSC Index, 1994). Organisational culture influences the organisation's ability to adapt to change. The existing culture contains beliefs and values that are often no longer appropriate or useful in the re-engineered environment. Therefore, the organisation must understand and conform to the new values, management processes, and the communication styles that are created by the newly-redesigned processes (*Business Process Re-engineering RIP,* 1996) so that a culture which upholds the change is established effectively (Bruss and Roos, 1993). In a newly re-engineered organisation, people usually share common goals and thus become more capable of working co-operatively without competing against each other (Andrews and Stalick, 1994). As BPR supports teamwork and integration of labour, co-operation, co-ordination, and empowerment of employees become the standard attitudes in the re-engineered work environment. However, trust and honesty among team members is also needed, and within the organisation as a whole (Dixon *et al.,* 1994; Jackson, 1997).

Stimulating the organisation's receptiveness to change

Preparing the organisation to respond positively to BPR-related change is critical to success (Benjamin and Levinson, 1993; Barrett, 1994; Bruss and Roos, 1993). When people are made resilient to change, they remain positive during uncertainty, focused, flexible, organised, and pro-active (Jackson, 1997). Leveraging organisational change requires effective one-to-one and one-to-many interactions to enrol key influencers of both individuals and groups within and without the organisation (Hall *et al.*, 1993; Guha *et al.,* 1993; Jackson, 1994).

Factors relating to management competence

Sound management processes ensure that BPR efforts will be implemented in the most effective manner (Bashein *et al.,* 1994). The most noticeable managerial practices that directly influence the success of BPR implementation are top management support and commitment, championship and sponsorship, and effective management of risks.

Committed and strong leadership

Commitment and leadership in the upper echelons of management are often cited as the most important factors of a successful BPR project (Hammer and Stanton, 1995; Jackson, 1997; Stanton *et al.*, 1993; Bashein *et al.*, 1994; Cooper and Markus, 1995; Harrison and Pratt, 1993; Towers, 1994; Rastogi, 1994; Furey, 1993; Hall *et al.*, 1993; Dixon *et al.*, 1994; Holland and Kumar, 1995;

Berrington *et al.*, 1995; Talwar, 1993; Guha *et al.*, 1993; Carr, 1993; Zairi and Sinclair, 1995; CSC Index, 1994; Arendt *et al.*, 1995; Feltes and Karuppan, 1995). Leadership has to be effective (Holland and Kumar, 1995; Zairi and Sinclair, 1995), strong (Jackson, 1997; Janson, 1992), visible (Jackson, 1997; Bashein *et al.*, 1994), and creative in thinking and understanding (Hammer and Champy, 1993) in order to provide a clear vision of the future. This vision must be clearly communicated to a wide range of employees who then become involved and motivated rather than directly guided (Carr and Johansson, 1995; Hammer and Stanton, 1995). Commitment to (Guha *et al.*, 1993, Berrington and Oblich, 1995; Dixon *et al.*, 1994) and support for (Rastogi, 1994; Dixon *et al.,* 1994; Furey, 1993) the change must constantly be secured from senior management throughout a BPR project (Dixon *et al.,* 1994). Sufficient authority and knowledge, and proper communication with all parts in the change process, are important in dealing with organisational resistance during BPR implementation (Hammer and Champy, 1993, Stanton *et al.*, 1993).

Championship and sponsorship

Barriers such as political, economic, and organisational risks are all associated with BPR-related change. And champions of the change play a major role in overcoming these barriers and increasing the chance of successful BPR implementation (Harrison and Pratt, 1993; Dixon *et al.*, 1994; Worsley, 1994; Ovenden, 1994; Benjamin and Levinson, 1993; Hinterhuber, 1995; Arendt *et al.,* 1995). The champions must be able to persuade top management of the need to change and to continually push the change efforts throughout the organisation. Political and material sponsorship by the champions of change to business processes, job definitions, reward systems, and organisational structure needs strong support from senior management (Hagel, 1993; Bashein *et al.*, 1994; Harrison and Pratt, 1993; Berrington and Oblich., 1995; Barrett, 1994; Arendt *et al.*, 1995; Dawe, 1996).

Management of risk

BPR implementation involves radical change to several systems in the organisation. Risks associated with acceptance of changes in the organisational structure, deploying emerging ITs with little familiarity, large investment in new resources needed for the new processes, loss of personnel, and loss of earnings (Towers, 1994; Clemons, 1995) are some examples of the many risks that an organisation may take when implementing BPR. Therefore, continuous risk assessment is needed throughout the implementation process (Talwar, 1993) to deal with any risk at its initial state (Towers, 1994) and to ensure the success of the re-engineering efforts. Anticipating and planning for risk-handling is important for dealing effectively with any risk when it first occurs (Clemons, 1995).

Factors relating to organisational structure

As BPR creates new processes that define jobs and responsibilities across the existing organisational functions (Davenport and Short, 1990), there is a clear need to create a new organisational structure which determines how BPR teams are going to look, how human resources are integrated, and how the new jobs and responsibilities are going to be formalised.

An adequate job integration approach

Several researchers emphasise that designing and implementing an adequate organisational human resources infrastructure is important to a BPR project's success (Zairi and Sinclair, 1995; Guha *et al.,* 1993; *Has Re-engineering had its 15 Minutes of Fame?,* 1995). Job and labour integration (case worker) is the most appropriate approach of human resources design that supports the process-based organisational structure rather than a function-based one (Davenport and Nohria, 1994; Hammer, 1990). When individuals within a process perform a series of tasks efficiently, product quality, processing time, and cost are all going to improve (Morris and Brandon, 1991). However, the move to integrate human resources architecture necessitates a careful consideration of all related organisational changes.

Effective BPR teams

Cross-functional BPR teams are a critical component of successful BPR implementation (Johansson *et al.*, 1993; Barrett, 1994; Towers, 1994; Furey, 1993; Dawe, 1996). Teams should be adequately composed (Hagel, 1993; Zairi and Sinclair, 1995; Dixon *et al.*, 1994; Harrison and Pratt, 1993; Carr, 1994; Klein, 1994; Moad, 1993). Team members should be experienced in variety of techniques (Carr and Johansson, 1995; Kettinger *et al.,* 1997). Teams should be made up of people from both inside and outside the organisation (Hammer and Champy, 1993). The determinants of an effective BPR team are as follows: competency of team members (Rastogi, 1994), their credibility within the organisation and their creativity (Barrett, 1994), team empowerment (Carr, 1993), motivation (Rastogi, 1994), effective team leadership (Berrington and Oblich, 1995), the training of members in process mapping and brainstorming techniques (Carr, 1993), proper organisation of the team (Guha *et al.*, 1993), complementary skills among team members, adequate size, interchangeable accountability, clarity of work approach, and specificity of goals (Katzenbach and Smith, 1993).

Appropriate job definitions and allocation of responsibilities

As BPR results in a major structural change in the form of new jobs and responsibilities, it becomes a prerequisite for successful implementation to have formal and clear descriptions of all jobs and responsibilities that the new designed processes bring along with them (Talwar, 1993).

Factors related to BPR project management

Successful BPR implementation is highly dependent on an effective BPR programme management (CSC Index, 1994) which includes adequate strategic alignment (Guha *et al.*, 1993), effective planning and project management techniques, identification of performance measures (Zairi and Sinclair, 1995), adequate resources, appropriate use of methodology (Carr, 1993), external orientation and learning (Jackson, 1997), effective use of consultants (Davenport, 1993), building process vision (Talwar, 1993), effective process redesign, integrating BPR with other improvement techniques (Zairi and Sinclair, 1995), and adequate identification of the BPR value (Guha *et al.,* 1993).

Aligning BPR strategy with corporate strategy

As corporate strategy determines objectives and guidance on how organisational capabilities can be best utilised to gain competitive position, BPR strategy, accordingly, guides the alteration of tasks and flows into integrated processes, and variance in how tasks are performed and the flow of material, people, and information becomes a source of competitiveness (Hammer, 1990). Therefore, a consideration of the strategic context of growth and expansion (Bashein *et al.,* 1994), creating a top-level strategy to guide change (Carr, 1993), and careful alignment of corporate strategy with BPR strategy (Jackson, 1997; Guha *et al.,* 1993; Grover *et al.*, 1993; Bruss and Roos, 1993) are crucial to the success of BPR efforts.

Effective planning and use of project management techniques

Proper planning for the BPR project (Berrington and Oblich, 1995; Jackson, 1997) with adequate time frame (Zairi and Sinclair, 1995) are key factors in delivering a successful BPR project on time. Effective use of project management techniques (CSC Index, 1994) and managing people-related issues (Talwar, 1993) have also a crucial role in smoothing the flow of the process redesign stages. A comprehensive piloting of the new design (Jackson, 1997; Hammer and Stanton, 1995; Hall *et al.*, 1993), and learning from errors (Jackson, 1997) are particularly important for tuning a BPR implementation process to the most successful way. Measurement of project progress should also be maintained continually throughout a BPR project (*Is Re-engineering A Fad?,* 1996).

Setting performance goals and measures

Setting high goals for performance (Hagel, 1993; Guha *et al.*, 1993; *Is Re-engineering A Fad?,* 1996; Feltes and Karuppan, 1995) and extendable targets (Hagel, 1993; Hammer and Champy, 1993; Stow, 1993; Hall *et al.,* 1993) for BPR are important success factors. Identifying and setting performance measures (Zairi and Sinclair, 1995; Guha *et al.,* 1993; Gould, 1993) are also necessary as they indicate levels of achievement.

Adequate resources

Adequate resources (Furey, 1993; Bruss and Roos, 1993; Bjørn-Andersen and Turner, 1994; Boyle, 1995) and sufficient budget (Bashein et al., 1994) allocated properly are important for a successful BPR project.

Appropriate use of methodology

Establishing a disciplined approach for BPR (Berrington *et al.*, 1995; Benjamin and Levinson, 1993) and using a sound methodology (Carr, 1993; Guha *et al.,* 1993) are prerequisites for BPR success. A BPR methodology should be designed or selected creatively to satisfy the current needs of the organisation (Klein, 1994). Adequate customisation of available BPR methodologies determines the level of comprehensiveness and effectiveness that a new customised BPR methodology can reach (Kettinger *et al.,* 1997; Klein, 1994).

External orientation and learning

External orientation based on customer research, competitive analysis, and benchmarking is a critical element of successful BPR efforts (Carr, 1993). Benchmarking is an effective technique to learn from customers and competitors (Rastogi, 1994; Jackson, 1997; Harrison and Pratt, 1993; *Is Re-engineering A Fad?,* 1996; Zairi and Sinclair, 1995). Customers' requirements and expectations should be defined and measured for BPR (Hall *et al.*, 1993; Jackson, 1997; Rastogi, 1994), and processes should be defined broadly in terms of customer value (Rastogi, 1994). Benchmarking allows learning from other organisations' experiences in BPR, as well as learning from one re-engineering process to another in the same organisation (Caron *et al.*, 1994).

Effective use of consultants

Several authors suggest that an effective use of consultants is useful in ensuring successful implementation of BPR (Davenport, 1993; Harrison and Pratt, 1993; Towers, 1994; Rastogi, 1994; Klein, 1994; Clemmer, 1994). Consultants can bring to the organisation specialised skills, experience, and know-how that the organisation needs and it is both time-consuming and expensive for it to build internally (Shabana, 1996; Boyle, 1995). They can also provide a firm-wide view, encourage unity between members, and are usually neutral (Davenport, 1993). Success of consultants in BPR is determined by their level of experience in implementing similar projects in other organisations, as well as their ability to direct the re-ngineering efforts to areas of substantial benefits to the organisation (Shabana, 1996).

Building a BPR vision

Building an imaginative thinking and a clear and compelling vision for future processes is critical to the successful implementation of BPR (Talwar, 1993; Guha *et al.,* 1993; Bashein *et al.*, 1994; Jackson, 1997; Barret, 1994; Bjørn-Andersen and Turner, 1994; Davenport, 1993a; *Is Re-engineering A Fad?*, 1996). Process vision directs both long-term and day-to-day actions (Holland and

Kumar, 1995). A complete development of process vision includes evaluating business strategy to anticipate future processes, conducting customer-based assessment of performance targets, benchmarking similar BPR efforts, and developing process attributes and its performance measures (Davenport, 1993a).

Effective process redesign

Effective process orientation (Moad, 1993), appropriate level of process knowledge (Zairi and Sinclair, 1995), documentation of existing processes (Guha *et al.*, 1993), appropriate selection of core processes, and use of prototyping (Guha *et al.,* 1993; Benjamin and Levinson, 1993) are all critical components in successful BPR implementation. Adequate identification of process gaps (Guha *et al.*, 1993) and evaluation of effectiveness of current processes by making use of appropriate software tools to visualise and analyse them (Towers, 1994; El Sawy, 1997) is also useful. Identifying process owners is also vital to BPR implementation (Boyle, 1995).

Integrating BPR with other improvement approaches

Several researchers suggest that using continuous improvement techniques increases dramatic gains (Carr, 1993; Clemmer, 1994; Feltes and Karuppan, 1995). TQM is particularly suggested to be integrated with BPR (Guha *et al.*, 1993; Zairi and Sinclair, 1995).

Adequate identification of BPR values

BPR efforts should focus on identifying re-engineering opportunities (Guha *et al.,* 1993) and values to internal and external stakeholders (Champy, 1995; *Is Re-engineering A Fad?,* 1996). A continuous focus should be maintained on business objectives (Carr, 1993).

Factors related to IT infrastructure

Factors related to IT infrastructure have been increasingly considered by many researchers and practitioners as a vital component of successful BPR efforts (Brancheau *et al.*, 1996; Malhotra, 1996; Ross, 1998a; Broadbent and Weill, 1997). Effective alignment of IT infrastructure and BPR strategy, building an effective IT infrastructure, adequate IT infrastructure investment decision, adequate measurement of IT infrastructure effectiveness, proper IS integration, effective re-engineering of legacy IS, increasing IT function competency, and effective use of software tools are the most important factors that contribute to the success of BPR projects.

Adequate alignment of IT infrastructure and BPR strategy

BPR and IT infrastructure strategies which are both derived from organisation strategy are in need of effective alignment to ensure the success of the BPR initiative (Kettinger *et al.,* 1997; Venkatraman, 1993; Grover *et al.,* 1993; Martinez, 1995). IT can best enhance an organisation's position by supporting a

business-thrust strategy (McDonald, 1993). The business strategy should be clear and detailed (Earl, 1995). Top management should act as a strategy formulator who provides commitment for the whole process of redesign, while the IS manager should be responsible for designing and implementing the IS strategy (Henderson and Venkatraman, 1993). The strategy describes the role of IT in leveraging changes to the underlying business processes and infrastructures (Meador, 1994).

IT strategic alignment is approached through the process of integration between business strategy and IT strategy, as well as between IT infrastructure and organisational infrastructure (Henderson and Venkatraman, 1993). The degree of alignment between the BPR strategy and the IT infrastructure strategy is indicated by including the identification of information resources needs in the BPR strategy, deriving the IT infrastructure strategy from the business strategy, examining the IT infrastructure strategy against the BPR strategy, the active involvement of management in the process of IT infrastructure planning and IT managers in business planning, and by the degree of synchronization in formulating the two strategies (Reich and Benbasat, 1996).

Building an effective IT infrastructure

Researchers consider adequate IT infrastructure reassessment and composition as a vital factor in successful BPR implementation (Moad, 1993; Rockart and Short, 1989). Adequate understanding and identification of enabling technologies for redesigning business processes (Barrett, 1994; Guha *et al.,* 1993), proper selection of IT platforms (Guha *et al.*, 1993), effective overall system architecture (Jackson, 1997), adaptable and flexible IT infrastructure (*Technology Talks to Business with EAS*, 1997), and proper installation of IT components (Guha *et al.,* 1993) all contribute to building an effective IT infrastructure for business processes.

The IT infrastructure and BPR are interdependent in the sense that deciding the information requirements for the new business processes determines the IT infrastructure constituents, and a recognition of IT capabilities provides alternatives for BPR (Ross, 1998a; Venkatraman, 1993). Building a responsive IT infrastructure is highly dependent on an appropriate determination of business process information needs (Johnston and Gibbons, 1975). This, in turn, is determined by the types of activities embedded in a business process, and their sequencing and reliance on other organisational processes (Sabherwal and King, 1991). Variance in how activities are performed and the flow of materials, people, and information can be a source of competitive advantage (Hammer, 1990).

An IT infrastructure is made up of physical assets (Malhotra, 1996b; Broadbent and Weill, 1997; Kayworth *et al.,* 1997; Ross, 1998a), intellectual assets (Broadbent and Weill, 1997; Kayworth *et al.*, 1997; Ross, 1998a), shared services (Broadbent and Weill, 1997; Kayworth *et al.*, 1997), and their linkages (Kayworth *et al.,* 1997; Ross, 1998a). The way in which the IT infrastructure

components are composed and their linkages determines the extent to which information resources can be delivered. An effective IT infrastructure composition process follows a top-down approach, beginning with business strategy and IS strategy and passing through designs of data, systems and computer architecture (Malhotra, 1996; Ross, 1998a). Linkages between the IT infrastructure components, as well as descriptions of their contexts of interaction, are important for ensuring integrity and consistency among the IT infrastructure components (Ross, 1998a). IT standards also have a major role in reconciling various infrastructure components to provide shared IT services that are of a certain degree of effectiveness to support business process applications, as well as to guide the process of acquiring, managing, and utilising IT assets (Kayworth *et al.*'s, 1997). The IT infrastructure shared services (Broadbent and Weill, 1997; Kayworth *et al.,* 1997) and the human IT infrastructure components, in terms of their responsibilities and their needed expertise, are both vital to the process of the IT infrastructure composition.

Adequate IT investment and sourcing decisions

Adequate investment (Zairi and Sinclair, 1995) and an IT sourcing strategy (Earl, 1996) are critical to the success of BPR projects which involve considerable re-engineering efforts of the IT infrastructure components.

A successful IT infrastructure investment decision should be guided by corporate strategies. A key starting point in an effective IT investment decision process is translating the strategic context into comprehensive strategic statements that are simple, achievable, practical and easy to communicate across the firm (Broadbent and Weill, 1997). This process should also include expectations for IT investment in the firm, data access and use, hardware and software resources, communications capabilities and services, and architecture and standards approach (Broadbent and Weill, 1997).

A sourcing decision should make a trade-off between internal and external sourcing (Earl, 1996; Walker and Weber, 1984). A multisourcing strategy (Hoffman, 1997) is effective for organisations that insource their strategic IT components while outsourcing common and non-critical components. When an outsourcing decision is about to be taken, there is a need to ensure that: the vendor's level of IT expertise and skills are sufficient and up-to-date, the deployment costs are considered as part of outsourcing cost, and that effective linkages are defined between outsourcer and IT staff in the organisation (Earl, 1996).

Adequate measurement of IT infrastructure effectiveness on BPR

Information and IT are the information resources that a business process needs (Sabherwal and King, 1991) to create a competitive value to an organisation and, therefore, they are essential assets that need to be acquired, used, managed, and measured to judge the value obtained by investment in information resources (Earl, 1997). Thus the measurement of IT effectiveness is an important factor in successful BPR implementation. Measurement of the IT

infrastructure effectiveness determines IT deficiencies that exist when business process information resource requirements cannot be met by the current IT infrastructure capabilities.

The measurement process may start with a number of policies and goals which are then translated by the IS function into measures by exploiting other techniques such as monitoring, auditing, and benchmarking. A test of developed measures is conducted and a continuous refinement and review are performed continually as strategies change and as the IS function discovers new means for measurement (Earl, 1997). Measures can be customised from different models (Fiedler *et al.*, 1997) to fit the specific needs of an organisation.

Proper IS integration

The effective integration of various organisational IS is vital to successful BPR implementation (Jackson, 1997). IS integration for BPR can be measured by the extent to which various information systems are formally linked for the purpose of sharing complete, consistent, accurate, and timely information among business processes (Bhatt, 1996; The DoD, 1994). Data integration and communication networking are the most important enablers for IS integration (Teng *et al.*, 1994; Grover *et al.*, 1995; Bhatt, 1996).

The success of the data integration effort depends on the level of integration between organisation planning and IS planning (Teng and Grover, 1992), top management support, user involvement (Goodhue *et al.*, 1988), leadership, effective communication, systematic implementation (The DoD, 1994), the degree of interdependence between business units, the need for flexible action by subunits, the degree of difficulty in designing and implementing systems with integrated data, and the degree of inter-operability between systems (Jackson, 1997).

The effective re-engineering of legacy IS

BPR projects often require revamping of the IS to deliver the full potential of the redesigned processes (Teng *et al.*, 1994; Moad, 1993). Re-engineering legacy IS to new systems that use the latest technologies is a key factor in creating an integrative IT infrastructure that supports BPR efforts effectively (Towers, 1994). Critical to this effort is the need for goal-setting and quantitative benefits measures, the role of planning, and the need for determining organisational readiness for re-engineering (Tilley, 1996). Organisational readiness is determined by capability assessment, training needs, surveys of application usage, identification of application evolution trends, operational deployment considerations, and organisational change issues (Tilley, 1996). Automated re-engineering of legacy systems can also add to the effectiveness of this process (Liu *et al.,* 1996; *Process Modelling and Legacy Systems*, 1996).

Increasing the IT function competency

Building a high performance IT function to accommodate the radical shifts in both technology and business is considered a critical factor in the success of

BPR efforts (Moad, 1993; Earl *et al.*, 1997). Appropriate IT function structure (Laud and Theis, 1997), adequate IT management architecture (Boynton *et al.,* 1992), building IT function competencies (Ross, 1998b), effective IT function benchmarking (Gordon, 1994) and IT function performance measurement (Saunders and Jones, 1992) all contribute to the effective role that the IT function plays in BPR. Architectural understanding, programming language and structure of code, dependencies on special language or platform features, and the cumulative effects of continuous maintenance all affect the ability to re-engineer a legacy system (Tilley, 1996). Systems reusability is also an important feature which facilitates the re-engineering efforts (Tilley, 1996). The involvement of maintenance personnel who are familiar with the legacy systems has a positive impact on quality and productivity of the re-engineering efforts (Tilley, 1996).

An effective IT function needs to be designed into a comprehensive and flexible structure that focuses on quality (Laud and Theis, 1997), value creation (Laud and Theis, 1997) and delivery (Ross, 1998b), empowerment through education (Laud and Theis, 1997) and re-skilling of IT staff (Earl *et al.,* 1997; Moad, 1993), motivation of employees (Laud and Theis, 1997), partnerships between all parties involved in managing IT resources (Laud and Theis, 1997) based on mutual trust and credibility (Ross, 1998b; Earl *et al.,* 1997), better strategic planning (Laud and Theis, 1997; Ross, 1998b), faster solution delivery (Roos, 1998), cheaper IT operations and support (Ross, 1998b), and satisfied customers (Ross, 1998b). Distribution, and patterns of IT managerial responsibilities and interdependencies should be specified and adequately implemented to help organisations develop an effective IT management architecture for BPR (Boynton *et al.*, 1992). Benchmarking of the IT function is also an important tool by which areas of improvement are identified along with descriptions of how they can be improved (Gordon, 1994).

Effective use of software tools

Several researchers argue that effective use of modern software tools to assist in BPR efforts is crucial to BPR success (Klein, 1994; Kettinger *et al.,* 1997; Carr and Johansson, 1995; El Sawy, 1997). Use of software tools contributes to BPR success by improving productivity (Klein, 1994), completing projects more quickly (Kettinger et al., 1997), producing higher quality results (Klein, 1994), baselining visions and measuring process costs (Carr and Johansson, 1995), and eliminating non value-added work and focusing instead on value-added work (Klein, 1994).

Effective software tools should have specific features, such as being usable by non-technical people (Klein, 1994), process visualisation (El Sawy, 1997), providing interactive and graphical-based demonstrations of process phases (Davenport, 1993), the ability to analyse processes (El Sawy, 1997) and show information flows between phases as well as rates of flows and resources usages (Davenport, 1993), enhancing the clarity of the BPR team's vision (Klein, 1994), enabling the running of life simulations to discover bottlenecks

and constraints (Davenport, 1993), enforcing consistency in analysis and design (Klein, 1994), facilitating integration with CASE tools that are widely used in designing BPR underlying information systems (Davenport, 1993), permitting iterative and top-down refinement from the BPR project goals to solution (Klein, 1994), and producing an acceptable return on investment (Klein, 1994).

BPR failure factors

Factors related to change of management systems and culture

(1) Problems in communication:

- Inadequate communication of need to change (Davenport, 1993; Grover *et al*., 1995; Buday, 1993);
- Hiding uncertainties in communication (Jackson, 1997);
- Poor communication between BPR teams and other personnel (Grover *et al.*, 1995);
- Lack of motivation and reward (Hammer and Champy, 1993; Grover *et al.,* 1995; Davidson, 1993).

(2) Organisational resistance:

- Resistance to change (Talwar, 1993; Moad, 1993; Jackson, 1997; Bashein *et al.,* 1994; Stanton *et al.,* 1993; Hoffman, 1997; Hendry, 1995a,b; Dawe, 1996);
- Fear, lack of optimism, and skepticism about BPR results (Bashein *et al.,* 1994; Davenport, 1993);
- Worries about job security (Jackson, 1997);
- Fear of job loss (Talwar, 1993);
- Fear of loss of control and position (Davenport, 1993; Hammer and Champy, 1993; Stanton *et al.,* 1993);
- Middle management impermeability (Jackson, 1997);
- Lack of adequate planning for resistance to change (Hammer and Champy, 1993; Grover *et al.*, 1995; Davidson, 1993; Arendt *et al.,* 1995)

(3) Lack of organisational readiness for change:

- Need for change management is not realised (Grover *et al.*, 1995);
- Lack of determination/courage/skills of management for radical changes (Randall, 1993);
- Demand for change exceeds the capacity to absorb (Jackson, 1997);
- Lack of cross-functional co-operation (Grover *et al.,* 1995; Davenport and Short, 1990);
- Line managers are not receptive for change (Grover *et al.,* 1995).

(4) Problems related to creating a culture for change:
- Underestimating the human side (*Is Re-engineering A Fad?*, 1996; *The Trouble with Reengineering*, 1995);
- Not considering existing management systems and organisational culture (Zairi and Sinclair, 1995; Davenport, 1993; Davidson, 1993; Grover *et al.,* 1995);
- Values ignorance (Hammer and Champy, 1993; Grover *et al.,* 1995; *Business Process Re-engineering RIP*, 1996; Hall *et al.*, 1993);
- A lack of trust between management and employees (*Has Re-engineering had its 15 Minutes of Fame?* 1995);
- The tendency to copy others (*Business Process Re-engineering RIP*, 1996);
- Underestimating the role of politics in BPR (Grover *et al.,* 1995);
- Animosity toward and by IS and human resources specialists (Bashein *et al.,* 1994).

(5) Lack of training and education:
- The absence of theory (*Business Process Re-engineering RIP*, 1996);
- Lack of understanding of BPR (Grover *et al.,* 1995; Davenport, 1993, Alter, 1990);
- Lack of appropriate training for those affected by BPR (Davenport, 1993; Grover *et al.,* 1995; Hall *et al.,* 1993).

Factors related to management support

(6) Problems related to commitment, support, and leadership:
- Lack of sustained management commitment and leadership (Bashein *et al.,* 1994; Hammer and Champy, 1993; Grover *et al.,* 1995; Hall *et al.,* 1993);
- Lack of top management attention and support (Randall, 1993; Davenport and Short, 1990; Grover *et al.*, 1995; Alter, 1990);
- Lack of support from line managers (Grover *et al.,* 1995);
- A "Do It to ME" attitude (Bashein *et al.,* 1994).

(7) Problems related to championship and sponsorship:
- Lacking the visible sponsorship of senior management (*Is Re-engineering A Fad?* 1996; Hoffman, 1997);
- Wrong sponsor (Bashein *et al.*, 1994);
- Lack of a champion (Hammer and Champy, 1993; Gulden and Reck, 1992; Grover *et al.,* 1995; Hoffman, 1997);

Factors related to organisational structure

(8) Ineffective BPR teams:

- Lack of a cross-functional project team (Hoffman, 1997);
- Difficulty in finding suitable teams members (Grover *et al.,* 1995);
- Lack of IS staff credibility and involvement in re-engineering teams (Moad, 1993; Davenport and Short, 1990; Grover *et al.*, 1995; *Is Re-engineering A Fad?,* 1996; Hoffman, 1997);
- Inadequate communication among members (Grover *et al.*, 1995);
- Lack of training for BPR teams (Davenport, 1993; Grover *et al.,* 1995);
- Lack of authority given to BPR teams (Grover *et al.*, 1995);
- Inadequate team skills (Hoffman, 1997).

(9) Problems related to the integration mechanism, job definition, and allocation of responsibilities:

- Inflexible hierarchical structures (Davenport, 1993; Grover *et al.*, 1995);
- People think solely in terms of their own immediate working group (Jackson, 1997);
- Conflicts between BPR team responsibilities and functional responsibilities (Grover *et al.,* 1995; Davenport, 1993);
- Unclear definition of jobs (Hammer and Champy, 1993; Grover *et al.,* 1995; Katzenbach and Smith, 1993).

Factors related to BPR project management

(10) Problems related to planning and project management:

- Inadequate planning for BPR project (Grover *et al.,* 1995; Davidson, 1993);
- Compressing the time needed to succeed (*Is Re-engineering A Fad?* 1996; Randall, 1993);
- Not enough time to develop new skills for BPR (Grover *et al.,* 1995);
- Too many improvement projects underway (Bashein *et al.,* 1994);
- Variable quality of ideas for BPR (Jackson, 1997);
- Incomplete restructuring of an organisation (Hall *et al.,* 1993);
- Extremely radical process change (Grover *et al.,* 1995; Davenport, 1993);
- Too incremental and not enough radical process change (Grover *et al.,* 1995; Hall *et al.,* 1993);
- Missing assessment of BPR project performance in the early stages (Davenport and Short, 1990; Grover *et al.*, 1995);
- Inability to control BPR efforts (Grover *et al.,* 1995).

(11) Problems related to goals and measures:
- Lack of clear performance objectives and milestones for BPR project (Dixon *et al.*, 1994; Hagel, 1993; Randall, 1993);
- Poorly defined needs (*Business Process Re-engineering RIP*, 1996);
- Difficulty in establishing performance goals (Grover *et al.*, 1995; Davenport, 1993);
- Difficulty in measuring BPR project performance (Grover *et al.,* 1995; Hall *et al.*, 1993);
- Using only quantifiable and easy measures (Grover *et al.,* 1995);
- Spending too much time in analysing existing processes (Hammer and Champy, 1993; Grover *et al.*, 1995).

(12) Inadequate focus and objectives:
- Narrow technical focus (Bashein *et al.,* 1994; Moad, 1993);
- Cost-cutting focus (Bashein *et al.,* 1994; Coulson-Thomas, 1994);
- Absence of strategic focus (Rastogi, 1994);
- Focusing on planning rather than on doing (*Is Re-engineering A Fad?* 1996);
- Using re-engineering to avoid making hard decisions (*Is Re-engineering A Fad?* 1996);
- Old patterns of automating existing processes without redesign (Hammer, 1990; Moad, 1993; Furey, 1993)
- Short-term view and quick fix mentality (Grover *et al.,* 1995).

(13) Ineffective process redesign:
- Missing process understanding and orientation (Hammer and Champy, 1993);
- Missing process owners (Furey, 1993; Jackson, 1997; Hammer and Champy, 1993; Grover *et al.,* 1995);
- Inadequate determination of scope of change (Hall *et al.*, 1993; Hagel, 1993; Grover *et al.,* 1995);
- Inadequate focus on core processes (Randall, 1993);
- Re-engineering the wrong processes (*Is Re-engineering A Fad?* 1996; Grover *et al.,* 1995);
- Narrowly defined processes (Hall *et al.*, 1993).

(14) Problems related to BPR resources:
- Lack of required resources for BPR efforts (Hammer and Champy, 1993; Cole *et al.*, 1993);
- Unsound financial condition (Bashein *et al.,* 1994);

- Not understanding the total financial impact (*Is Re-engineering A Fad?* 1996);
- Difficulty in forecasting human, financial, and other resources (Grover *et al.,* 1995).

(15) Unrealistic expectations:

- Unrealistic scope and expectations (Bashein *et al.,* 1994; Hall *et al.,* 1993; *Business Process Re-engineering RIP,* 1996; Hoffman, 1997);
- Expecting BPR to solve all organisational problems (Davenport, 1993; Grover *et al.,* 1995; Rigby, 1993).

(16) Ineffective use of consultants:

- Poor implementation by consultants (*Business Process Re-engineering RIP,* 1996; Boyle, 1995);
- Lack of external consultants' support for BPR process (Grover *et al.,* 1995).

(17) Miscellaneous problems:

- Lack of adequate BPR methodology (Klein, 1994; Davenport, 1993; Grover *et al.,* 1995);
- Inappropriate identification of customer's needs for BPR (Grover *et al.,* 1995; Davenport, 1993; Furey, 1993);
- Lack of BPR vision (Grover *et al.*, 1995; Schnitt, 1993; Harrison and Pratt, 1993);
- Difficulty in financially justifying value of BPR (Grover *et al.,* 1995);
- Piecemeal implementation (Hendry 1995a,b).

Factors related to IT infrastructure

(18) Problems related to IT investment and sourcing decisions:

- Optimizing lower-level processes that can be outsourced for cheaper cost and less efforts (*Is Re-engineering A Fad?* 1996);
- Premature IT outsourcing (McFarlane and Nolan, 1995; Earl, 1996);
- Costing models fail to consider the totality of system elements (Tilley, 1996).

(19) Improper IS integration

- Inadequate treatment of compatibility issues (Tilley, 1996);
- Insufficient telecommunication infrastructure capabilities (Davenport, 1993; Grover *et al.,* 1995; Venkatraman, 1994);
- Insufficient database infrastructure capabilities (Davenport, 1993; Grover *et al.,* 1995);

- Insufficient IS application infrastructure capabilities (Davenport, 1993; Davidson, 1993).

(20) Inadequate IS development:

- Failure to deliver the right IS applications on time (Moad, 1993);
- Rushing off IS development process (Moad, 1993);
- Inability to change IS development approach to process-based (Jackson, 1997).

(21) Ineffective re-engineering of legacy IS:

- Existing IT systems (Zairi and Sinclair, 1995; Davenport and Stoddard, 1994; Hoffman, 1997; Boyle, 1995);
- Legacy systems were not initially designed with reuse in mind (Tilley, 1996);
- Lack of documentation, or obsolete documentation (Tilley, 1996);
- Loss of human system expertise (Tilley, 1996);
- Inability to recover total system architecture (Tilley, 1996);
- Re-engineering unfinished systems (Tilley, 1996);
- Insufficient understanding about existing IT infrastructure (Davenport, 1993; Grover *et al.*, 1995).

(22) Miscellaneous problems:

- Failure to mutually consider and align both business strategies and IT infrastructure strategies (McDonald, 1993; Venkatraman, 1993; Davenport and Short, 1990; Cole *et al.*, 1993; Grover *et al.,* 1995; Boyle, 1995);
- Lack of IT expertise (Davidson, 1993; Grover *et al.,* 1995);
- Difficulty of modelling and simulating the new business processes (Davenport, 1993; Grover *et al.,* 1995);
- Failure to continually assess emerging IT capabilities (Davenport, 1993; Grover *et al.*, 1995);
- Failure to aggressively use IT enablers (Grover *et al.,* 1995).

Conclusion

Figure 1 provides a summary of the factors discussed in this paper. It can be used as a checklist by which organisations undertaking, or planning to undertake, BPR efforts can ensure that their BPR-related change efforts are comprehensive, well-implemented, and have the minimum chance of failure. Future work includes assessing the criticality of these factors in BPR implementation based on a global survey of organisations in both the USA and Europe.

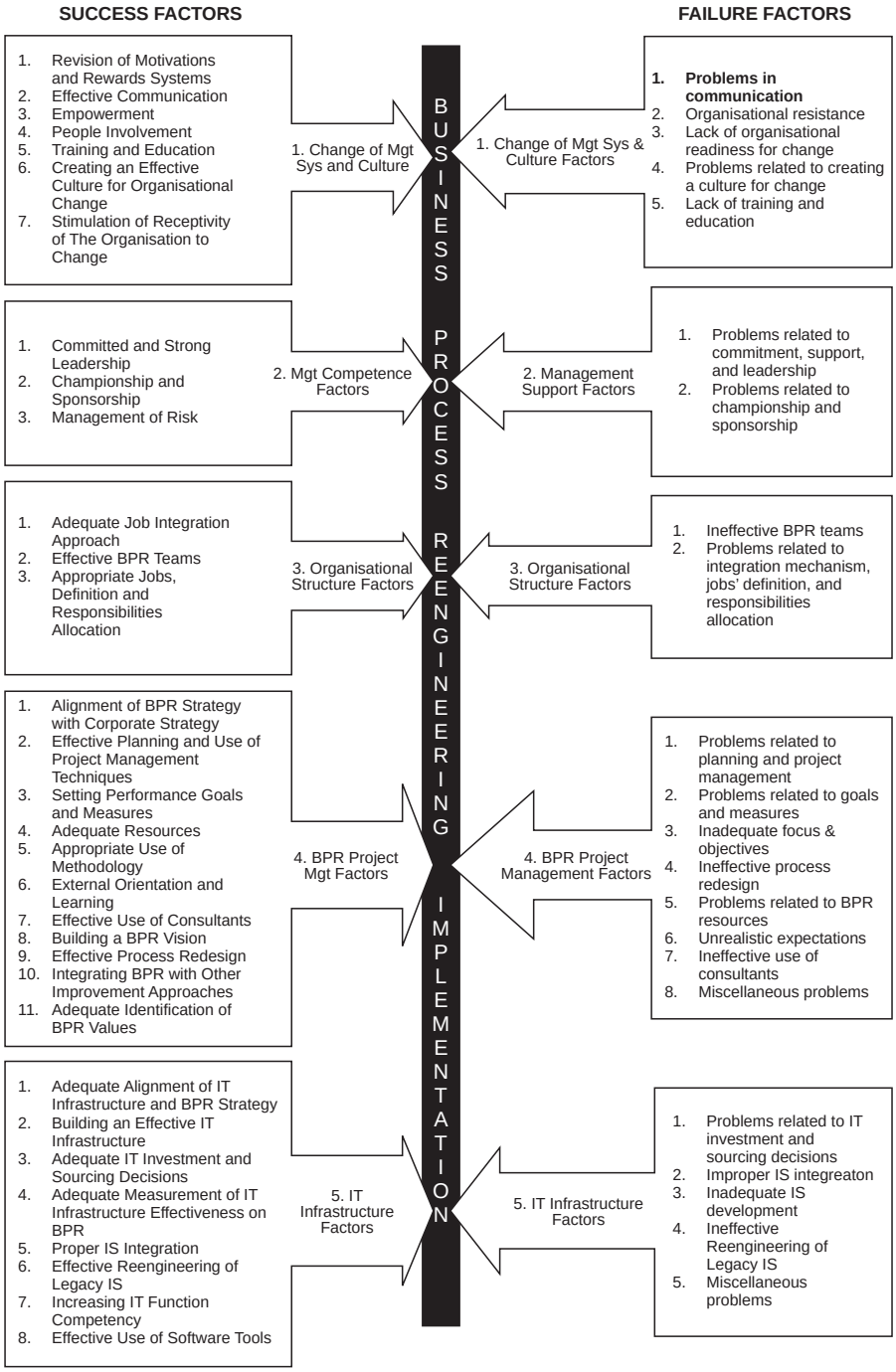

Figure 1.
A summary of key success/failure factors in BPR

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