Implications for the Role of Information Systems in a Business Process Reengineering Environment

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Organizations are increasingly adopting business process reengineering (BPR) initiatives to achieve multiple performance improvements through fundamental reengineering of work. Because of their expertise, techniques, and style of thinking, IS experts are well positioned to play a significant role in supporting and leading, when appropriate, many of the activities throughout reengineering projects. This role may include, but is not limited to, managing complex large-scale BPR projects, identifying and maintaining a technological vision in support of BPR efforts, developing process-oriented information systems, and managing the ongoing changes in business processes. Implications for such a role include repositioning IS to have business, customer, and information orientations, reinventing its activities, and resharpening its skills to properly function in such a new environment.

IS executives in the 1990s (e.g., Cafasso, 1993; Alter, 1994; Moad, 1994; Revenaugh, 1994). Given the skills and tools of its experts, the IS function is well positioned to play a major role in initiating and implementing BPR efforts. While the enabling role of IT is widely discussed in BPR literature, little is said regarding the potential role of the IS function in a BPR environment. The purpose of this paper is to elaborate on specific examples of such a role and its implications on the IS function. In this discussion, IS is viewed as a component of the enterprise which provides the internal clients and external customers with products, services and capabilities through the use of IT.

BPR: A Background

Organizations need to reinvent themselves and develop strategies critical to achieve competitive advantages (Hayes & Pisano, 1994). One way to achieve such an objective is to create small organizational units that include all the activities...
necessary to complete a task (Child et al., 1991). BPR involves the examination and alteration of a system to reconstitute it in a new form. It rejects the assumptions inherent in Adam Smith's industrial paradigm—the division of labor, economies of scale, hierarchical control, and all other related roles and principles of an early-stage developing economy. BPR calls for searching for new models for organizing work. It suggests abandoning the existing functional structure altogether, and redesigning the organization itself—or at least key parts of it—to better fit the new reality (e.g., Hammer, 1990; Huff, 1992; Hammer & Champy, 1993a; Moad, 1993; Vogl, 1993; Dixon et al., 1994).

BPR is viewed as the fundamental rethinking and radical redesign of the business processes to achieve major improvements in performance measures such as cost, quality, service, flexibility, and responsiveness (Fried, 1991; Hammer & Champy, 1993a, p. 32). Reengineering demands performance improvements along new dimensions (Dixon et al., 1994). Thus, BPR results in a fundamental transformation in a business—the way it operates, its structure, its business processes, its people, and its culture (e.g., Tapscott & Caston, 1993, p. 207; Caron, 1994; Scott, 1995). Davenport (1993, p. 2), however, views reengineering as only part of what is necessary in order to radically change processes. He argues that "process innovation" efforts target the achievement of radical improvements in the performance of the process through the use of innovative tools and work designs. It also encompasses the envisioning of new work strategies, the actual process design activity, and the implementation of the change in all its complex technological, human, and organizational dimensions.

Whether it is called process redesign, process innovation, process engineering, or process reengineering (Revenaugh, 1994), the goal of BPR is to achieve performance breakthroughs by applying innovative ways of doing business. BPR aims at simplifying every cycle of activity within a business by eliminating non-value added steps and reducing the number of actions in each process. BPR requires the definition of a vision, the creation of new structures, the development and implementation of the new designs, and the establishment of feedback and continues improvement systems.

Although there is universal agreement on the common objectives of BPR efforts, the details of a specific method or approach to performing its activities may vary from one initiative to another (Scott, 1995). This variation can lead to overlooking variables that are critical to the success of BPR projects. Recent BPR literature (e.g., Fried, 1991; Davenport, 1993; Hammer & Champy, 1993b; Tapscott & Caston, 1993; Khalil, 1995) suggests seven key activities (or phases) that are critical to successful planning and implementation of BPR projects. These activities are: (a) assessment of the organization's readiness for change, (b) identification and prioritization of problematic business processes, (c) identification of change enablers (i.e., IT), (d) analysis of business to establish links between its strategy and the visions of the identified process, (e) analysis of the process, (f) design of the new process, and (g) implementation and management of the new process.

Although the undertaking of the large-scale BPR projects poses a challenge to virtually all groups in the organization, the challenge is particularly pertinent to the IS group. Because of their expertise, techniques, and thinking style, IS experts are well positioned to play a major role in support of many of the activities throughout the reengineering project (i.e., Davenport, 1993; Martinez, 1995; Tapscott and Caston, 1993).

Hence, BPR has become one of the most critical issues for IS executives in the 1990s (e.g., Moad, 1994).

**IS Role in BPR**

While there is a universal agreement on the critical role of the IS function in the success of BPR efforts, experts are still debating the nature of such a role. To some, the unique role and relationship of IS with the various business units of an organization make it the perfect business strategy leader (Tapscott & Caston, 1993, p. 220); and empirical evidence provides some support for the view of the leading role of IS in BPR practices (e.g., Cafasso, 1994; Jovanovic & Mrdalj, 1994). Normally, no other function in an organization has such unique duties and license to cross functional boundaries and to drive change as IS has. In the course of systems planning or data modeling projects, IS experts can identify and expose the problematic aspects of current processes and make business executives aware of them.

On the other hand, some experts assert that IS can not and should not play a leadership role in BPR (e.g., Gillin, 1992; Huff, 1992; Wilder, 1992; Moad, 1993; Tapscott & Caston, 1993, pp. 219-220; Alter, 1994; Maglitta, 1994a; Menagh, 1994; Martinez, 1995). BPR is essentially a learning enterprise that must be undertaken by those who will learn to work together differently. IS simply does not possess the necessary power, and often also lacks sufficient corporate good will and trust to lead such a project. In addition, BPR is not primarily a technological project. Thus, IS should not be a driver of BPR or aspire to run reengineering projects. Instead, it should expect to be a part of the teams that lead these projects.

Nevertheless, IS has an important role to play in the completion of the activities throughout the BPR life cycle as well as in the redesign of the processes and their supporting systems. IS should be a partner that can provide education, support, and leadership, when appropriate. Top executives should ensure an essential role for IS in providing valuable expertise and guidance in BPR projects. The significance of such a role is not just because of IS experts’ technical skills, Michael Hammer underscores, but because of their style of thinking, which supports both IS work and BPR approach (Maglitta, 1994a). IS experts understand the organization’s
processes, are accustomed to change, and are oriented toward new technology. Within this context, four areas where IS can significantly contribute to BPR efforts are discussed below.

**Managing BPR Projects**

Evidence from BPR projects suggests that the later work of prototyping, experimentation, design, development, and implementation of new business models in a BPR project are relatively difficult (Martinez, 1995). This difficulty is due to such factors as organizational resistance, complexity of required quality communications with those outside the reengineering teams, and the challenge of putting together a working business model agreeable to all the participants in the BPR project.

BPR projects are risky, which is attributable to projects' complexity, rather than to their radical and innovative aspects. Because of their accumulated experience with managing large-scale information systems, IS leaders are most likely to have the necessary skills to manage BPR projects (Davenport, 1993; Tapscott & Caston, 1993; Martinez, 1995). Although the organization's other functional areas (i.e., marketing, finance, human resources) are intellectually challenging and difficult, they may not expose managers to the demands of large-scale, cross-functional projects as IS does.

Using process oriented methodologies (i.e., structured analysis, data modeling, process modeling, decomposition diagramming) and tools (i.e., data flow diagrams, flowcharting, ends/means analysis, object-oriented modeling, simulators), business processes can be modeled, simulated and prototyped (e.g., Katz & Katz, 1994; Moad, 1994; Ettl, Fingar, & Read, 1995). The primary challenge in BPR, however, is managing the transition from creative prototyping and experimentation to implementation of well-structured, tangible solutions.

Once creative thinking has been translated into IT-enabled new business processes and concepts, the overall solution should be effectively, completely, accurately, and reliably implemented (Martinez, 1995). Developing creative solutions to problems requires iteration through concepts, design, and prototypes. Once a decision is made to begin supporting a business activity on the reengineered model, success depends on a well-managed effort to ensure implementation of quality systems and procedures.

Without IS powerful tools (i.e., integrated database, applications, distributed computing) and IS expertise in systems implementation, the reengineering initiatives could not proceed beyond modest prototypes. It is the IS responsibility to ensure that the IT-enabled solutions output from each reengineering team fit together and are integrated. Further, IS can help BPR teams control some of the other challenges and risks in managing large-scale projects, including complexity, resistance to change, lack of experience, and understanding migration (Martinez, 1995).

**Providing Technological Vision**

While billions of dollars have been invested in IT (i.e., hardware, software, telecommunications, and data management), productivity has not grown as much as hoped because IT has implemented existing business rules and structures. In BPR, IT is an essential catalyst, serving as an essential tool that supports the redesigned business processes and facilitates cross-functional work flow (Hammer & Champy, 1993b, p. 44; Kim, 1994). The survival of a modern organization depends on the ability of its IT architecture to respond to the constantly evolving information needs of its business processes (Drakopoulos & Merges, 1995).

IT fosters process orientation and empowerment of people (Steinberger, 1994; Kirschner, 1995). Technology implementation, however, is a complex specialty. Without a grounding in technology, few business managers are capable of assuming this leadership role. Thus, they must recognize that IS experts can and should take leadership and visionary roles in devising ways to use IT in support of the reengineered processes. The IS role should not be reduced to doing what business managers ask and to fixing technology when it breaks (Martinez, 1995). Instead, BPR demands that IS play a technology leadership role that requires innovative and visionary thinking. In doing so, IS must, however, balance its leadership in its area of expertise with supportive partnership with business managers.

Without IS know how, the role of IT in enabling new work systems is inconceivable. The lack of an IS technical leadership role in the determination of an organization's technological vision could lead to focus only on certain visible technology and overlook the need for overall IT infrastructure. IS experts can develop a holistic framework (IT architecture) of necessary technical components that must gradually be built to support the new model (Hammer & Champy, 1993b; Tapscott & Caston, 1993; Daly, 1994; Menagh, 1994; Martinez, 1995). This IT architecture has advantages for business because it allows processes that leverage technology to be implemented within the context of a flexible, evolving technology plan (Drakopoulos & Merges, 1995). IS group is the group that is most capable of translating the reengineered business vision into IT architectures.

**Developing Process Oriented Information Systems**

Process orientation in a BPR environment demands building information systems along the cross-functional processes. Building systems to support the newly reengineered business processes requires strategic planning of information systems across the organization. If BPR mandates the organization of business tasks from the cross functional process perspective, a top-down approach for information systems
IT Strategic planning can reveal the shortcomings and inefficiencies of the current organizational structure and business practices for possible reengineering. By employing a methodology such as information engineering (IE), an information architecture (IA), a set of implementation-independent design specifications of the information systems can be constructed. The IA, which is the foundation of business activities and of information systems development, is composed of the data and process architectures of the organization (Kim, 1994). A data architecture of the organization can be constructed by using data-oriented methodologies (i.e., entity-relationship model, object-oriented model). The data architecture specifies the data elements and their relationships that reflect the information needs of the organization. This data architecture is independent of the functional and geographical boundaries of the organization and, therefore, is relatively stable even with the drastic change of BPR. The identification and maintenance of the stable data elements of an organization's activities are fundamental to the building of the organization's IA. Once established, data architecture becomes a solid foundation for BPR.

A process architecture, which is independent of any particular IT implementation, describes the activities of the organization and how it uses the information specified in the data architecture. Methods for describing business processes and establishing a process architecture of the organization include data flow diagram (DFD), process hierarchy diagrams, and process dependency diagrams (Kim, 1994). In a BPR environment, process architecture is expected to be less stable, compared to the data architecture.

Without prompt changes in information systems, business processes cannot be reengineered. While processes are relatively variant over time, data used by these processes are usually relatively stable. When building information systems, the invariant data should be the center of development. Hence, BPR requires rigorous analysis and modeling of data in the first place. This analysis should provide a robust foundation for building a data architecture upon which many processes and applications programs can be built (Kim, 1994).

Process Management

BPR is a continuous long-term, not a project-oriented, change process. It is an ongoing program of coordinated projects that are conducted over a long period of time (i.e., Sprague and McNurlin, 1993, p. 90). Also, once a process is designed, it needs to be managed for continuous improvement until another radical change is warranted. Further, reengineering gains are difficult to sustain and integrate without having in place a high level process management function (Caron, 1994; Moad, 1994; Martin, 1995). Such a function should focus on developing and maintaining a business vision for engineering, assessing and improving the organization's adaptability to changing competitive environment and business processes, analyzing existing processes and selecting the proper improvement approach (i.e., classic BPR, modest continuous improvement), coordinating ongoing reengineering efforts, providing tools and methodologies to BPR teams, managing and monitoring the performance of the reengineered processes, and diffusing and leveraging learning from one project to another.

Effective undertaking of the responsibilities of the process management function requires experience with organizational change disciplines, ranging from small scale continuous improvement techniques to the principles governing organizational overhaul (Martin, 1995). It also requires knowledge of IT and organizational culture, and the ability to combine, balance, and leverage high-level technical knowledge with business shrewdness. Given the knowledge and skills of its human resources, IS is a potential source for providing such qualifications.

As such, the process management function should either be closely allied with the central IS function in the organization or be a part of the function itself. In either case, IS expertise and tools can help coordinate BPR efforts and link them with the organization's strategic planning. For instance, IS experts can use the mostly object-oriented workflow tools to develop a visual map that describes the processes of the organization. The map can be continuously updated, maintained, and compared with the strategic plan to determine candidate processes for reengineering. Additionally, the consequent business objects facilitate continual changes to business processes and quicker development of the supporting information systems.

Given the importance of the potential IS role in BPR, one might raise questions regarding the implications of the new paradigm for the nature and structure of the IS function, its relationship with the business it serves, and the alignment of its strategies with the organization's strategies.

The Implications

With the increasing emphasis on BPR and IS role in such environment, corresponding implications for critical IS activities and human resources are expected. Five of such implications are discussed below.

Business Focus

IS has to change its mission to cope with the new challenges that BPR poses (Hoplin, 1994). As IS becomes part of mission-critical business functions, IS professionals need to break the psychological barriers of the back room inhabit-
ants to become front lines warriors. IS leaders and professionals need to turn their attention from the computing infrastructure to the firm's information needs. They must change the IS culture from the narrow technical orientation to the support of the larger goals of the organization (Keen, 1988).

In managing the organization's information resources, policy making emphasis should be shifted from reducing costs and improving internal operating procedures--administrative efficiency—to a multifaceted mechanism for unifying the whole organization and directly delivering products and services to the customer (Kastrud, 1991; Tapscott & Caston, 1993, p. 261; Hoplin, 1994; Teer, Forcht, & Pierson, 1994). Within such a context, IT investment will be justified, for instance, based upon the need to build systems that permit concurrent information exchange throughout the process, which shorten the design-to-distribution cycle time (Betts, 1992; King, 1992; Daly, 1994).

**Information Focus**

If information is a key organizational resource (Byrne, 1992), then information management should be a natural target for a process orientation. Additionally, information plays an important role in BPR (Davenport, 1993, p. 73, 77). Better information should make processes more efficient and effective. Just the addition of information to a process can in itself lead to radical performance improvement. Furthermore, information facilitates the measurement and monitoring of a process performance, the integration of activities within and across processes, the customization of processes for particular customers, and the achievement of longer-term planning and process optimization.

Managing information flow within and between business processes is a prerequisite to achieving BPR success. Thus, separating information from IT is essential because much information in organizations and processes is not manipulated by IT. And when the two are not separated, information seems to get less attention. Ironically, this focus on IT rather than information has led to questioning the real benefits of an investment in IT (Davenport, 1993, p. 86). The problem is that the information management has been dominated by an engineering design/architectural kind of model such as IBM's Business Systems Planning and strategic data modeling. Typically, most architectures address only the technology component, not the human component (Sprague & McNurlin, 1993, pp. 14, 544; Hoplin, 1994; Maglitta, 1994b).

In order to prepare the organization's climate for BPR, the much neglected information side of information systems management should be addressed. IS has to reposition itself to pick up the high value-added business change/information route rather than the low-level plumbing route (e.g., Davenport, 1994; Katz & Katz, 1994; Maglitta, 1994b; Meyer, 1995). Creating a position of chief information officer—not an information technology officer—with the responsibility of developing an information map to unite the different types of functionally-based information in an integrated entirety is a good first step for shifting to an information focus outlook.

**Customer Focus**

Adopting the customer focus is central to the new IS paradigm in a BPR environment. This focus leads into very innovative technologies which would never have been considered otherwise. Internal customers need systems that integrate tools at the desktop, bridge applications across the enterprise, and reach out externally (e.g., Kiely, 1993; Tapscott & Caston, 1993, p. 260). They need work-group applications that would manage the new team-oriented processes. This work group environment requires intelligent workstations, LANs, and integration with the mainframe world.

The need to adopt the customer focus calls also for the adoption of an "information ecology" approach to information management (Davenport, 1994). This approach recognizes the importance of knowing how people—as living and thinking entities—use and share information and whether they share such information. It also ensures focusing on establishing information policies, creating and maintaining information warehouses, coordinating organization-wide information acquisitions, initiating efforts to improve information quality, building information centers and libraries based on users needs, designing organization-wide information products and services, and negotiating the sharing of information among the organization's members (Davenport, 1993, p. 88).

By adopting a customer focus strategy, IS executives must develop and use process-oriented and customer-oriented measures and be willing to take direction from their customers. It is only when they participate in product teams and learn how a product moves through the different phases of the product life cycle that they can implement computer-based systems to reduce time to market. IS executives must be able also to articulate and forge a vision of the role of IT in the organization's future. They should be prepared to play an active role in providing business leadership in the use of IT, and in being the architect who is responsible for the formation of IT infrastructure.

**New Approach to Systems Development**

The practice of information systems development has not often followed the principle of simplifying before automating. Instead, systems development proposes automating as a means of simplifying. Yet, in the new process-oriented environment, IS needs to totally rethink how systems are developed, starting from scratch. One of the first ideas that will have to go is the whole notion of traditional systems development life cycle (Maglitta, 1994a). If IS organizations don't adapt to the new environment, they will end up just maintaining legacy applications and taking a back seat on BPR (Moad, 1993).

BPR requires not only quicker delivery of systems but...
also the ability to create those systems in an entirely new way that fits the newly designed processes (Moad, 1993; Teer, Forcht, & Pierson, 1994). The focus should be on processes, not IT (Jarvenpaa & Stoddard, 1993). Processes should be reengineered first; then IT tools should be applied to the new processes (Verity & McWilliams, 1991; Ciampa, 1993). In taking these steps, IS experts are expected to provide an understanding of the impact that information and technology have on business processes including concurrent operations, customer service, external focus (alliance), empowerment of people, etc. (e.g., Slater, 1992; Alter, 1994; Jovanovic & Mrdalj, 1994).

In addition, many information systems have been built within the context of the traditional functional, command and control management systems. They are designed to funnel functional information up the hierarchy and present information in a functional, rather than in a process-oriented manner. It is likely, that these systems pose technological barriers to communication and, in some cases, symbolize organizational isolation (Shina, 1991, p. 287). Effective use of information in managing processes calls for structuring information along process lines, rather than functional lines (Hammer, 1990; Davenport, 1993, p. 79). Only when systems design is geared toward a process orientation, organizations will begin to generate information that will support real-time analysis of how good their processes are. Consequently, "[a]alyzing business problems and finding effective IS solutions will hence become the single important activity for IS in the future" (Lee, Trauth, & Farwell, 1995, p. 327).

In designing new systems, designers should not assume that people will share information easily, and should understand that changing an information system will change an organization's information culture. Changing the technology only reinforces behaviors that already exist. Changing an organization's information culture, however, requires altering basic behaviors, attitudes, values, management expectations, and incentives that relate to information (Davenport, 1994).

**Re-skilling IS Human Resource**

Supporting BPR presents major changes in IS activities and, consequently, in IS professionals. It is imperative for IS professionals to become involved in, and understand the business operations, and the integrated systems requirements of the reengineered organizations (e.g., Davis, 1993; King, 1993). Meeting the challenges of such new roles calls for re-skilling IS human resource to enable them to become more intuitive and creative.

While a typical description of a systems analyst's role in many organizations has included the study and analysis of operations performed in factories and offices, little has actually been carried out (Davenport, 1993, p. 38). It is a real challenge for systems analysts to informate—use the information gathered about the automated processes to improve them—rather than to merely automate (e.g., Zuboff, 1988; Hammer, 1990; Silver, Markus, & Beath, 1995). The systems analyst's role is expected to include more strategic responsibilities such as evaluating an organization's information systems strategy within the context of its business needs and goals (Graf & Misic, 1994), recognizing the relevance of information systems to the long-term health of the business, determining the architecture, standards, methodology and tools the organization uses to develop software, as well as managing portfolios.

Further, there is a growing need for IS experts with process reengineering know-how. Solid reengineering skills (i.e., process analysis, adaptability to dramatic change, creative thinking, having a business insight, skills in management and communication) are becoming more critical than the typical set of technical skills which were more important in the 1970s (e.g., Couger, 1988; Davenport & Short, 1990; Hammer, 1990; Eliot, 1994; Graph & Misic, 1994; Lee, Trauth, & Farwell, 1995). In the 1990s and beyond, the demand is high for IS professionals who have knowledge and skills in business operations, management, technology, and interpersonal skills to effectively lead organizational integration and BPR activities (e.g., Forcht, Kulonda, & Moates, 1987; McCusker, 1990; Niederman, Brancheau, & Wetherbe, 1991; King, 1993; Trauth, Farwell, & Lee, 1993; Maglitt, 1994a; Lee, Trauth, & Farwell, 1995).

Finally, IS is a critical part of the fabric of the organization. Changing that fabric is expected to simultaneously cause a change in the IS. While IS professionals have been dispersed into business units, they are also emerging as centralized architects of data, communications and standards, as well. IS experience, techniques, and tools are valuable in reengineering processes and building systems to support them (Menagh, 1994). Ignoring the IS role, BPR efforts could easily result in unrealistic and inappropriate or even disastrous technology choices.

**Conclusions**

Undertaking of BPR efforts poses a challenge to virtually all groups in the organization and to the IS group in particular. Because of their expertise, techniques, and style of thinking, IS experts are well positioned to support and lead, when appropriate, many of the activities throughout reengineering projects. While it is important to have a partnership between IS and the business managers in planning and executing BPR projects, IS should not sponsor BPR initiatives. There is much about BPR that can never be under the control of the IS function.

Nevertheless, the challenges facing IS groups in a BPR environment are formidable. They are expected to help support reengineer business processes, while keeping current operations running smoothly. To meet the challenge, business and IS executives should cooperate to redefine the IS role and mission and prepare its experts to take a leading role in BPR efforts (Martinez, 1995). This role may include, but not be
limited to, managing complex large-scale BPR projects, identifying and maintaining a technological vision in support of BPR efforts, developing process-oriented information systems, and managing the ongoing changes in business processes.

If IS wishes to play a central role in a BPR environment, it has to carry the strategically more important role of change agent, move from being reactive to proactive, and IS has to become a need-driven force intimately intertwined with the business. IS has to reposition itself to have business, customer, and information orientations, reinvent its tasks, and resharpen its skills to properly function in the new environment.

References


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