



Information technology infrastructure, organizational process redesign, and business value: An empirical analysis

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ABSTRACT

We extend current research examining synergies between information technology, process redesign, and firm performance in three ways: analyze a firm's entire IT and BPR portfolio, examine production and market value performance implications, and conduct analysis using a unique dataset of 228 firms between 1996 and 1999. We find a contingent association between IT, process redesign, and performance. The interaction of IT and BPR portfolios is positively associated with firm productivity and market value. However, we find mixed evidence of a difference in these impacts across different types of BPR. Insights for business investment in IT and process redesign are discussed.

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1. Introduction

Business process redesign (BPR) is an approach to improving organizational performance that focuses on business processes and their efficiency [30,46,47]. The concept has evolved from its reengineering roots into today's process-based approach to organizational change (e.g., quality management, human resource management, and customer relationship management) [3,18,64]. The promise of substantial financial gain has motivated numerous firms across a wide range of industries to adopt major process change initiatives [20,69,71], with some achieving significant benefits [7,69]. However, documented rates of redesign failure are also high, with some estimates as large as 70% [47]. Collectively, the conflicting evidence of both BPR success and failure has led to a "paradox of BPR outcomes," warranting further investigation to assist managers in their evaluation of process change opportunities [43].

The variability in BPR success is rooted in many factors, including the challenge of implementing information technology to support process redesign. Information technology is often a central component of BPR and at times is promoted as a key motivator for the change itself

[46,47]. Continued innovation in IT and its capabilities implies that IT's role in process redesign is not likely to diminish. Case-based research illustrates specific challenges to successful process change and how to overcome them. However, it remains unclear whether IT-enabled process change, examined across large numbers of organizations, is a rational investment for firms. In addition, there is a deficiency in knowledge concerning the interplay between business process redesign, information technology, and organizational performance at the program-level (i.e., across all projects in a firm).

In this paper, we contribute to the literature by analyzing the interplay between process redesign, information technology, and organizational performance. At any given time, a single organization may have many process redesign efforts underway. Cigna, for instance, completed 20 reengineering initiatives over a five-year span [21]. While examining the value generated from individual process redesign projects is informative, the single-project approach does not indicate whether all BPR projects in a firm, taken together, are positively associated with firm performance. Moreover, evaluating a single project in each organization may introduce bias given the likelihood of within-firm heterogeneity in process redesign success. Our unique data set, collected by the Center for Effective Organizations at the University of Southern California, contains information about an organization's entire *portfolio* of redesign projects. This allows us to comprehensively evaluate the performance impact of the BPR method in firms, contributing to an existing research stream which primarily examines BPR across only one or a few individual projects.

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We examine two related research questions. First, do the outcomes of all projects in a firm's process redesign portfolio impact the firm's overall performance? Second, what is the contribution of information technology to the performance improvement generated by a firm's process redesign portfolio? We analyze these questions in depth by using a unique dataset of firms spanning multiple years and industries, assessing performance via productivity and market value, a performance measure not previously examined in BPR literature. We also introduce two principal categories of process redesign – *cost rationalization* aimed at doing more with less and *work restructuring* aimed at implementing new business processes – as part of our analysis. Taken together, our research contributes to the literature through its analysis of a firm's *entire portfolio* of BPR projects, an assessment of their performance impacts including market value, and a detailed examination of two widely adopted types of BPR.

Our evaluation of the comprehensive impact from a firm's BPR program is both relevant and timely. Spending on process change projects is expected to reach over \$6 billion annually within the next four years. Given the mixed results of previous research, our study provides new information that will inform managers in their evaluation of BPR spending at the program-level. Moreover, information technology has long been promoted as a central tenet of process redesign [46,47] with current forms of process change continuing the call for IT investment (e.g., business process management) [22,28]. Our research allows us to examine if IT is indeed essential for effective BPR implementation.

Several principal results emerge from our empirical analysis. First, the combination of information technology and process redesign is found to be synergistic. Both the value added during production and the market value of a firm are positively and significantly affected by the interaction of a firm's information technology and BPR portfolios. Second, when examining the IT-BPR relationship further, we identify variations in performance impacts depending upon the focus of process redesign. When independently examining the combination of IT and BPR focusing on work restructure, we find evidence of a positive performance association with respect to production and market values. On the other hand, when analyzing IT and cost rationalization BPR, we find evidence of a positive and significant relationship with production value but not market value. We also find a difference in the incremental impacts of high versus low levels of BPR use. Whether it is high levels of cost rationalization or work restructure, the IT-BPR combination has a negative incremental impact on firm market value. In contrast, no incremental change in production value is identified for different usage levels of either type of BPR.

The mixed results are not surprising given the wide range of process redesign initiatives and multiplicity of contexts. Rather than indicating that combined investment in information technology and BPR is not fruitful, as a benefit does not occur uniformly, our analysis suggests that firms can take advantage of IT by taking into account the requirements of the BPR selected. In other words, rational managers must select the right type of information technology based upon a firm's process redesign goals, regardless of the type of BPR involved. Taken together, the results support our basic proposition that process redesign and IT are synergistic and provide a rational investment opportunity for enabling strategic organizational change.

In the next section we describe theoretical foundations and develop research hypotheses. We then explicate our research methodology, including data sources, theoretical models, and empirical methods. We then discuss empirical results, summarize key findings, and discuss implications.

2. Theory and hypotheses

2.1. Process redesign

Business process redesign (BPR) involves the creation of new and innovative business processes [30,47] and represents one way a firm

can adapt to changes in the competitive environment. It is especially relevant in the current business climate, enabling a firm to create flexible business processes that meet the demands of today's dynamic, information-intensive, global marketplace [22]. The new processes implemented through BPR reflect a philosophy of process efficiency across all business functions involved, a fundamental shift from the focus on functional efficiency in the Industrial era. To redesign a business process, firms invest in a variety of work practices to implement a desired set of activities that create a service or product output that is valued by a customer, whether internal or external. In today's high performing organizations, the types of work practices that can be implemented as part of a business process can include the adoption of self-managed teams, new incentive plans, assignment of decision responsibility, work cells, information sharing policies, and the like [4]. The types of practices implemented are dependent upon the objective (i.e., the process) of the BPR project.

Process redesign is one of many programs that can produce positive organizational change. Other programs utilized by firms include employee involvement, total quality management (TQM), lean manufacturing, six sigma, and business process management. Managers must be cautious when considering BPR and other such programs, as at times, they can be insufficient given the challenges faced by the organization [7]. However, when key processes are redesigned correctly, whether incrementally or radically, BPR has the potential to improve overall firm performance [30,46–48,70].

2.2. Process redesign, information technology, and organizational performance

Information technology provides organizations with the flexibility to redesign processes and create a high-performing organizational design [16]. This results, in part, from the information processing capabilities enabled by modern IT; capabilities that were previously unavailable when many existing business processes were originally designed [31] but are required by modern work practices [49,63]. Enterprise software, for example, offers a common data infrastructure across an organization, providing work cells with the ability to access all functional data necessary to complete their assigned tasks. Broadband networks allow for the free flow of information, enabling the timely *sharing* of critical data with employee teams regardless of location. Business intelligence applications improve corporate decision making through the effective *analysis* of corporate data. Internet-based networks also create an effective control environment where centralized managers can *monitor* the performance of empowered employees, helping to ensure that appropriate decision rules are being followed.

Research demonstrates that information technology plays an important, complementary role in process redesign. The information capabilities enabled by IT make technology investment an important complement to work practices associated with organizational change [11,49]. Firms with higher levels of IT investment have been found to have a greater application of decentralized decision authority, use of self-managed teams, and cross-functional units [49]. These and other such work practices leverage the informing and automating capabilities of technology to enable new forms and types of organizational structure, decision authority, human resource management, and the like [14,16,29]. Teams, for example, may be more effective when integrated with technology as IT's capabilities help to fulfill the information management and knowledge sharing needs of its members [58]. Other organizational factors found to complement IT are employee behavior, worker composition, size, and culture [17,66].

Complementary investment in information technology and process redesign shape organizations in two stages [56]. First, IT and BPR assets bring about informational, automational, and transformational

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