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Business Process Design and Organizational Structure: Technological, Operational and Economic Issues

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. Primary Research Areas

Business process reengineering, information technology & organization design, economics of information systems, agency theory, queuing theory, supply chain management

Research Motivation

Business process redesign has been a central issue for many corporations over the last few years. The seminal articles described radical transformations that were supposed to produce dramatic improvements in firm performance. However, there have been widely varying results of applying these reengineering paradigms. A large number of articles in the trade press have suggested that inadequate implementation strategies are responsible for the failures in BPR efforts. However, it is also possible that some of the principles themselves lead to less efficient process designs in certain settings; in other words, they may not be universally applicable.

Academic researchers have studied the organizational, operational and technological issues involved in process design; however, work thus far has not studied the implications of *simultaneous* changes of these aspects on the performance of business processes or the internal structure of the firm. There is no formal research that indicates when process redesign is desirable, or what process designs are optimal in a particular setting. There is no clear idea of what mix of information systems a firm should use when it chooses a particular work system design and control system. There is also the issue of causality - whether the design of work systems and the structure of an organization should be driven by the available technology, or whether the development of technology should be driven based on what best suits business needs. The managerial implications of convincing answers to these open research questions are very significant.

This dissertation is motivated by the need to develop a formal framework in which these issues can be addressed, and in which the following questions can be addressed and resolved.

Research Questions Addressed:

- (I) When is process redesign desirable, and how does the optimal design of a process depend on the parameters that describe it ?
- (II) What is the effect of simultaneous changes in information systems, work system design and managerial control mechanisms on the optimal design of a process, and the structure of an organization ?
- (III) How does the optimal mix of information systems depend on and affect the choice of work system design, allocation of decision authority, and control variables such as worker performance measures and incentive compensation schemes ?
- (IV) What characteristics or functionality in information systems are most desirable for a particular process design or organizational structure.

(V) How does the adoption of inter-organizational information technologies such as EDI for supply chain management change the internal structure of the firm and the design of business processes ?

Relevant Theories Applied

Research in change management & process redesign requires an inter-disciplinary approach - technology solutions that are optimal in isolation may be sub-optimal when other organizational factors are considered, due to the significant interaction effects between different process design parameters. The research in this dissertation combines the disciplines of information systems, operations management and economics & management.

Fundamental theories drawn from include (but are not restricted to) operations research (queuing theory, non-linear optimization, stochastic modeling) economic theory (agency theory, game theory, consumer theory, theory of the firm) and organization theory.

Preliminary Results

Initial findings, some of which are detailed in [16], [17], [18], and [19] are summarized below:

- Process redesign is *more desirable* when there are a large number of tasks, these tasks are non-uniform, job specification variability is high, and there are information asymmetries among workers and between workers and management. It is *less desirable* when tasks are uniform, knowledge intensive and there are low returns from information sharing
- The impact of information systems are enhanced by the redesign of work system, and the optimal investment levels in technology increase with process redesign. This effect is compounded by increasing returns to information systems investments.
- Enhanced information technology support & increased incentive based compensation tend to be *substitutable* (as opposed to complementary) drivers of performance enhancement; however, both could be *complementary* to the redesign of work systems.

Work in Progress

- Modeling the strategic and competitive effects of information systems, incentives & job specification variability on the decentralization of decision rights and the consolidation of tasks. The tradeoffs between the cost of control, and the cost of the incomplete use of available information are of significant importance, especially in the light of increased customer demands and mass customization.
- Examining issues of information ownership and control when processes are redesigned. A hybrid mix of centralization and decentralization appears to be a possible optimum.
- Modeling & analyzing the impact of information systems on the design and management of organizational performance control mechanisms. Contrary to what agency theory indicates, there may be cases in which ignoring available information may be the most efficient solution.
- Modeling & analyzing the impact of technology innovation in supply chain management on the design of processes and the structure of the firm

Research Methodology

In work thus far, I develop a series of mathematical models which draw primarily from queuing theory and agency theory. These models provide a rich framework for evaluating the multiple aspects of business processes, their associated information flows & task characteristics and the underlying organizational control mechanisms. The assumptions used as a foundation for my models are based on a series of case studies, and my ongoing work of almost a year with a process reengineering team at Xerox Corporation.

These models are used to characterize the 'best' process as a function of the work environment, the preferences of the workers in a firm and the potential I.T. implementation options. The combination of queuing & agency theory leads to extremely complex analytics, and it is not feasible to perform analysis using standard comparative statics techniques. Hence, after deriving closed form results that describe optimal structures, numerical simulation is used to generate indifference curves on two-dimensional projections of the parameter space. My results illustrate the settings in which different process designs are optimal, as well as the complementarities between different organizational changes. Validation of these results will be done through case-based testing using standard statistical methodologies

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