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Publication Date

1995-12-01

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Business Value of Information Technology*

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*Forthcoming in the Proceedings of the
Sixteenth Annual International Conference on Information Systems*

April 12, 2001

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This research was supported by grants from the National Science Foundation and Computer Sciences Corporation/
Consulting as part of NSF's Decision, Risk and Management Science program's Private Sector Initiative.

Keywords: Organizational characteristics (DA06 to DA10)
 Organizational Dynamics (DD01, DD04)
 IS Evaluation

Word count : 4,998

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ABSTRACT

In the current competitive environment, the need for better management of all organizational resources, and specifically IT, requires comprehensive assessment of their contribution to firm performance. However, there is little empirical evidence that IT is capable of creating value, nor has a comprehensive framework of business value emerged. Many of the available studies of IT productivity and business value were conducted using firm level output measures of value. The focus on firm level output variables, while important, provides only limited understanding of how value is created using IT. This paper develops a conceptual framework of the business value outcomes of IT by synthesizing the extant literature on IT business value and IT supported organization and process design. The framework provides a basis for process oriented studies of IT business value, and enhances our understanding of the links between information technology and firm performance.

1 Introduction

As business environments become ever more competitive there is an increased emphasis on operational efficiency, improved product and service quality, and responsiveness. Many business organizations have sought to use information technology (IT) as a means with which to achieve these objectives. Indeed, organizations are making significant investments in IT, currently accounting for about 50% of annual capital investments (Kriebel 1989). Surprisingly, there are few systematic guidelines as to how to measure the effectiveness of IT investments. In the current competitive environment, the need for better management of all organizational resources, and specifically IT, given its scale and importance, requires the development of comprehensive measures of its contribution to firm performance.

A number of studies of IT productivity and business value, defined as the contribution of IT to firm performance, have appeared (Cron and Sobol 1983; Turner 1985; Bender 1986; Loveman 1994; Strassman 1990; Harris and Katz 1991; Weill 1992; Brynjolfsson and Hitt 1993; Lichtenberg 1993; Markus and Soh 1993; Brynjolfsson and Hitt 1994). However, there is little consensus about the nature of IT business value -- or whether IT is capable of creating value. Many of the existing studies were conducted using only firm level output or end-product based measures of value. The singular focus on firm level output variables, while important, provides only limited understanding of how value is created using IT. Few studies analyze the impact of IT on intermediate business processes, which would generate considerable insight into the creation of business value of IT from a process perspective can be conducted. The importance and benefits of adopting process oriented perspectives of business value are well recognized within the academic literature (Crowston and Treacy 1986; Bakos 1987; Gordon 1989; Kauffman and Weill 1989; Wilson 1993) and its perceived significance by practitioners is indicated by the recent interest in process innovation and reengineering (Davenport 1993; Hammer and Champy 1993).

Our thesis is as follows. Firms derive business value from IT through its impacts on intermediate business processes. Such intermediate processes include the range of *operational processes* that comprise a firm's value chain and the *management processes* of information processing, control, coordination and communication. As IT continues to permeate and penetrate the organization, impacting an increasing number of processes at a deeper level, the potential business value of IT increases. This potential is further enhanced by redesigning business processes and by the associated modifications to organization structure. Such structural modifications result in new organizational forms that enhance the productivity and business value potential of IT. At the extreme, Beniger (1986) has suggested that contemporary IT is a substitute for organization itself.

This paper develops a process oriented conceptual framework of the business value of IT intended to enhance our understanding of the links between organizations and information technology, and the subsequent effects on firm performance. The benefits of such a process oriented perspective are as follows. First, a process focus should enhance the validity of the business value assessment, since the analysis is conducted at the same level that the technology is deployed. Second, the approach offers considerable insight into the processes by which value is created. Barua, Kriebel, and Mukhopadhyay (1995) state that "[s]tudies that attempt to relate IT expenditures directly to firm level output variables ignore the web of intermediate processes, where first order effects exist." Thus, an important benefit of process oriented studies is the ability to move beyond correlational evidence to explanation of the technological features, process characteristics, organizational settings, and competitive environments conducive to producing IT business value.

2 Literature Review

There are two major classes of studies that have focused on the links between IT and organizational performance. The first class includes studies that focus on IT business value, but pay limited attention to organizational context as an important moderator of the interaction of IT and organizations. The second class focuses on the impact of IT on organization structure, but does not analyze the implications, other than broadly, for business value.

2.1 Studies of Business Value

Many studies of IT business value and productivity impacts examine the link between IT investment and output measures of value and productivity. A number of these have been carried out at the industry and economy levels (Roach 1987; Bresnahan 1986; Osterman 1986; Baily and Chakrabarti 1988; Morrison and Berndt 1990), while others have focused on assessing the value of IT investments at the level of the firm (Cron and Sobol 1983; Turner 1985; Bender 1986; Loveman 1994; Strassman 1990; Harris and Katz 1991; Weill 1992; Brynjolfsson and Hitt 1993; Lichtenberg 1993; Brynjolfsson and Hitt 1994). The overall findings from this research have been contradictory, ranging from instances of insignificant or negative relationships between IT investment and various performance ratios (Loveman 1994; Berndt and Morrison 1992; Weill 1992; Mooney 1994), to bi-modal distribution of impacts for firms operating in the same industry (Cron and Sobol 1983; Strassman 1990; Harris and Katz 1991; Weill 1992) to conclusions of significant returns on investment (Brynjolfsson and Hitt 1993; Lichtenberg 1993; Brynjolfsson and Hitt 1994). The inconclusive findings have given rise to an active debate within the IS arena termed the "productivity paradox" (Baily and Gordon 1988). The nature of the paradox is that business organizations demonstrate ever higher levels of investment in IT in the absence of measured productivity gains.

Many propositions have been offered in the attempt to explain the productivity paradox. These explanations are as varied as the findings of the studies that generated the debate. In

response, some researchers have focused on the use of better datasets and methods to empirically demonstrate significant returns from IT. The recent findings by Brynjolfsson and Hitt (1993; 1994) and Lichtenberg (1993) of significantly higher return on investment for IT than for other forms of capital were among the first indications of some resolution to the productivity paradox debate. However, Mooney(1994) demonstrates that these analyses do not stand up to more detailed scrutiny, and that the datasets upon which they are based are quite problematic. Regardless of whether these studies successfully demonstrate the existence of positive returns on IT investment, their approach provides limited insight as to how these productivity gains can be realized by individual firms. Because of the failure of traditional productivity measures to capture productivity gains from IT, there is a growing consensus that a better understanding of IT impacts requires a shift from output focused to process oriented research (Bakos 1987; Gordon 1989; Banker et al. 1990; Banker and Kauffman 1991; National Research Council 1994). Beyond this, process-oriented studies offer greater potential for meaningful measures of IT business value and in addition offer better insight into how business value can be created through IT.

In short, our review of the IT business value and productivity impacts literature offers four main lessons: (i) studies based on output measures of IT impact have been of limited value in developing our understanding of IT impacts (ii) there is an emerging view that adopting a process perspective holds the key to additional insights into the IT business value issue; (iii) measures of productivity need to be expanded to capture the impacts of contemporary IT use; (iv) there is a need for a greater recognition of the importance of organizational context and competitive position in studies of business value.

2.2 Studies of IT, Organizations, and Organizational Processes

In view of the limitations of the existing studies of IT business value, in particular their focus on output measures, and the expectation that process oriented studies offer potential for deeper insights into business value issues, we turned to the literature on IT and organizations in

search of studies of IT and organization process. Changes in the technological and competitive environments have brought about new roles for IT in contemporary organizations. The potential role of IT in organizational design is well established (Galbraith 1977; Huber 1984; Miles and Snow 1986; Attewell and Rule 1984; Straub and Wetherbe 1989; Davenport and Short 1990; Huber 1990; Zmud 1990; Attewell 1991; Gurbaxani and Whang 1991; Davenport 1993; Hammer and Champy 1993). The literature on IT and organization processes is less developed by comparison. Porter's (1985) discussion provides one of the earliest frameworks for considering the role of technology in supporting and creating competitive advantage at the activity (process) level. Porter advocates using value chain analysis rather than analysis of value added as a better approach to the study of the economic and institutional outcomes of technology use. Venkatraman (1991) adopts the value chain framework in his discussion of "IT-induced business reconfiguration." Rockhart and Short (1991) also employ a value-chain perspective to consider the role of IT at the behavioral level in supporting the networked organization and the management of interdependence. Davenport (1993) in his discussion of the role of IT in supporting process innovation provides what is probably the most comprehensive analysis of the interaction of IT and organizations from a process perspective.

Thus, there is a substantial body of literature that discusses the relationships between IT and organizational structure, and a smaller body of work that addresses IT and organization process. However, while many authors recognize the role of IT in process improvement, none explicitly consider the business value of IT either in supporting these organizational re-design efforts, or the moderating effect of process and organization design on the relationship between IT and business value. Davenport (1993) states that "Process improvement and innovation are the best hope we have for getting greater value out of our vast information technology expenditures, yet neither researchers nor practitioners have rigorously focused on business process change as an intermediary between IT initiatives or investments and economic outcomes" (p.45) Many studies provide anecdotal evidence of the role and benefit of IT in organizational design and process improvement efforts, and others assume the existence of gain, but no empirical studies are evident.

2.3 The linkage between information technology, process and value

The business value of IT is a joint technology-organization phenomenon. Therefore meaningful investigation of this phenomenon requires theoretical perspectives of both technology and organizations, and their interaction. Few previous studies have employed an underlying theory of how IT use in organizations leads to business value, and indeed, we are still missing intuitive models of the interaction between IT and organization. This absence again suggests a need to move to the process level so that we might develop an understanding of this interaction. Consideration of IT's role at the process level in the context of IT business value will contribute to our understanding of the role and potential of IT to enhance organization process and structure. Indeed, Clemons and Reddi (1993) suggest that such an approach, as a means of building explanatory theory, has merit over attempts to force a phenomenon into pre-existing theory. Such insights will also be a valuable contribution to the literature on organizational structuring and business process re-engineering.

We have seen, therefore, that the literature on the one hand contains studies of the relationship between IT and output measures of business value that do not include adequate consideration of processes. On the other hand, studies of IT and organization structure and process do not incorporate consideration of the business value of IT. In the remainder of this paper we develop an integrative framework of IT, business processes, and business value. In developing this framework against the background presented this far, we considered that in order to be able to identify and study the process impacts of IT on business value, this framework should incorporate (i) a typology of business processes; (ii) a typology of potential impacts of IT on those processes; and (iii) a framework for analyzing the business value of IT created by its impacts on those processes.

3 A Process Perspective of IT Business Value

3.1 A Typology of Processes

Since one of the central objects of analysis in this research are business processes, it is important to develop a typology of such processes. Process has been defined as a "specific ordering of work activities across time and place, with a beginning, an end, and clearly identified inputs and outputs: a structure for action (Davenport 1993, p.5)." We adopt Davenport's (1993) classification of business processes into operational processes and management processes. We distinguish between operational and management processes as follows. Operational processes are those that embody the execution of tasks comprising the activities of an organization's value chain. In effect, operational processes constitute the "doing of business." Management processes, on the other hand, are those activities associated with the administration, allocation, and control of resources within organizations. "Management processes" should not be taken to refer only to those processes that are carried out by managers, or conducted at the management level of organizations. Our intention is to distinguish between processes associated with primary business operations, and the associated information handling, coordination, and control processes required to ensure the efficiency and effectiveness of the primary operations. While operational and management processes are inextricably linked, this does not detract from the utility of the typology as part of a framework for assessing the business value impacts of IT. Figure 1 illustrates the typology.

3.2 IT Impacts on Operational and Management processes

Previous authors have considered IT impacts along operational and managerial dimensions. For example, Malone (1987) suggests that, in general, organizational technologies consist of production and coordination technologies. In this regard, IT is unique in that it has implications for both operational and management processes. Indeed, Ciborra (1985) and Gurbaxani and Whang (1991) discuss the impact of information technology on both operational costs and the costs of coordination and control. In order to evaluate IT business value, the key

business processes within each core business area must be identified and the linkages and contributions of IT to those processes defined. Value chain analysis (Porter 1985), in which organizational activities are depicted as technologically and economically distinct processes that must be performed in order to do business, provides a useful backdrop for considering the impact of IT on operational and management processes. Operational processes are affected by such technologies as robotics, CAD, flexible manufacturing, data capture devices, imaging, and workflow systems. IT can improve the efficiency of operational processes through automation, or enhance their effectiveness and reliability by linking them. Management processes are enhanced by improved availability and communication of information. Electronic mail, databases, and videoconferencing can improve the efficiency and effectiveness of communication, thus contributing to management processes. Equally, and perhaps more importantly, IT can be applied to support interorganizational business processes, particularly the end-to-end linking of value chains of one organization with those of another organization. For example, a buyer's inbound logistics could be linked with the outbound logistics of a supplier. Alternatively, the sales and marketing operations of two organizations could be linked under a joint marketing program. Recently the growing numbers of value-added partnerships, and virtual corporations, have dramatically increased the level of inter-organizational arrangements. Electronic markets are also becoming more prevalent and have many implications for the organization of marketing and product delivery processes (Benjamin and Wigand 1995).

3.3 Business Process Re-engineering

The IS professional literature increasingly suggests that achievement of significant business value is attainable only in combination with business process re-engineering prior to the application of IT. Hammer and Champy (1993) describe business re-engineering as the "fundamental rethinking and radical redesign of an entire business system to achieve dramatic improvements in critical measures of performance." Davenport (1993) uses the term "process innovation" to include any "radical change" initiative as distinct from incremental process

improvements. The most common rationale for process innovation is improved financial performance, typically through cost reduction. Other process-based objectives, including time reduction, improved quality, improved customer service, are assumed to result in higher levels of sales or reduced cost of production. The potential for process re-engineering is easily accepted as, historically, few business processes have been designed with the capabilities of IT in mind (Hammer 1990). Most traditional applications of IT automated existing processes, but automation alone does not address their fundamental performance deficiencies (Hammer 1990), creates communications problems within processes (Davenport and Short 1990), and misses the real potential of computer technology to support entirely new models of how work is performed (Scott-Morton 1991; Hammer and Champy 1993).

While process re-engineering is not a technology endeavor, IT is recognized as having a critical role to play in re-engineering efforts, primarily as an enabler of new operational and management processes (Davenport and Short 1990; Hammer and Champy 1993; Davenport 1993). Furthermore, process innovation can be perceived as the mechanism for aligning the IT resource with the organization's business strategy. Thus, a key factor in the achievement of business value from IT investments will be its relationship with process re-engineering. Also, process re-engineering can be used to put process designs in place that are better suited to the application of IT, to the extent that IT might ultimately be used to automate these activities. We therefore embrace the concept of a duality between IT business value and business process re-engineering. Specifically, IT is considered to be an enabler of process innovation, on the one hand, while process innovation is considered to be a catalyst for the realization of the business value of IT. As a consequence of this duality, new organizational forms, in addition, must take into account both the competitive environment and the specific organizational context of the firm in question. Measures of business value must also be linked to specific elements of the business plans that spell out organizational performance criteria and targets. However, IT in itself cannot be held responsible for the ultimate success or failure of the business strategy. When skillfully applied, IT

can provide support for the intermediate processes that taken together comprise the execution of an organization's strategy. It becomes even more reasonable, therefore, that the business value of IT should be assessed at this process level rather than at the firm level. For example, if an organization decides to increase revenues through improved customer service, and employs IT to achieve higher levels of customer service, the business value of IT is realized if indeed it leads to higher levels of customer service. To assess the technology's impact on firm revenues is an unreasonable abstraction of its role and potential since ultimate revenues depend on the competitive viability of the strategy. The success of IT must be measured against its support for the intermediate process goals that form part of a firm's overall strategy.

In addition to improved measurement, a further benefit of this approach is that the impacts of IT at this intermediate business process level are generalizable, whereas the impact on the "bottom line" may not be generalizable. A final point is worth considering. Implicitly, studies that employ firm level output measures of business value consider only successful, or at least, surviving firms; firms that have failed, possibly because of their IT management, are excluded. Thus, if high levels of investment in IT or good management of IT are necessary conditions of survival but do not contribute directly to profitability, the positive effects (survival) of IT will not be captured. By adopting a process perspective of IT impacts, we can examine the impacts of IT on successful and unsuccessful processes rather than on firms, thus broadening and balancing the sample space, and again contributing to an improved understanding of IT impact.

In summary, we see the need for a process view of IT-organization interactions for the following reasons: (1) to identify the value adding mechanisms of IT; (2) to develop an approach and set of metrics for measuring the technology's business value; and (3) to enhance our understanding of the relationship between IT and organizations. Our belief is that firms derive business value from IT through its impacts on intermediate business processes. Business processes are comprised of the range of operational processes that comprise a firm's value chain and the management processes of information processing, control, coordination, communication and

knowledge. The approach to studying IT business value proposed here is thus through a focus on the fundamental ways by which the technology can improve management and operational processes. Figure 2 outlines a process oriented model of the business value of IT.

We propose that IT can have three separate but complementary effects on business processes. Further, it is through these effects on business processes that IT creates value. First, automational effects refer to the efficiency perspective of value deriving from the role of IT as a capital asset being substituted for labor. Within this dimension, value derives primarily from impacts such as productivity improvements, labor savings and cost reductions. Second, informational effects emerge primarily from IT's capacity to collect, store, process, and disseminate information. Following these effects, value accrues from improved decision quality, employee empowerment, decreased use of resources, enhanced organizational effectiveness, and better quality. Third, transformational effects refer to the value deriving from IT's ability to facilitate and support process innovation and transformation. The business value associated with these effects will be manifested as reduced cycle times, improved responsiveness, downsizing, and service and product enhancement as a result of re-engineered processes and redesigned organizational structures. Figure 3 below provides an illustration of these effects.

An alternative categorization of the process effects of IT was provided by Davenport (1993) who identified nine opportunities for process innovation through IT: automational, informational, sequential, tracking, analytical, geographical, integrative, intellectual, and disintermediating. Interestingly, all nine opportunities can be encapsulated easily and appropriately by our three dimensions of business value, thus adding to the face validity of our more parsimonious model. Specifically, automational fits directly with our notion of the automational effect of IT; informational, tracking, analytical, and intellectual opportunities are captured by the informational effects; while sequential, geographical, disintermediating and integrative opportunities can be considered dimensions of the transformational effect. Our model also

encapsulates the essence of Venkatraman's (1994) discussion of the potential benefits from IT-enabled business transformation, but is more encompassing as a general model of IT business value.

Further to the model proposed in Figure 3, we propose that the direct, or first order, business value impacts of each of these effects are associated primarily with either operational processes or management processes. Specifically, first order automational effects are primarily associated with operational processes. Informational effects emerge primarily from IT's impact on management processes such as information processing for decision making, coordination, communication and control. In the case of transformational effects, a common outcome of process and organization re-design is the merging of management processes with operational processes. More importantly, however, is that through these process and structural transformations, higher orders of business value are realized. The source of these higher orders of value is the extension of the automational effects of IT to management processes, and the extension of informational effects to operational processes. Specifically, in the case of operational processes, first order business value effects resulted from the automation of certain processes. However, as a consequence of process transformation, the information content of operational processes typically increases (Zuboff 1988). Consequently, operational processes become amenable to the information effects of IT previously accessible primarily to management processes. Second order (or indirect) value effects are thus created. In the case of management processes, first order effects typically arise from the informational effects that arise from the availability of better information for coordination, control, and decision making. However, process innovation efforts reduce the amount of information processing and the routine aspects of management processes, thus creating a second order business value effect through the introduction of automational effects within management processes. A third order of value originates from the new capabilities and new ways of doing business created by the transformational effect of IT.

The typology of business processes can be combined with the dimensions of business value to derive a framework that can be used to identify the business value impacts of IT. This

framework is shown below in Table 1. The framework provides a structure within which to consider the business value impacts of an existing or planned IT system. Our goal was not to propose a new methodology for business value assessment, or a specific set of measures. Indeed, consistent with Banker, Kauffman, and Mahmood (1993), we have argued against the appropriateness of a single methodology, or single set of measures. Nor was it our intention to propose a causal model of IT business value. Thus, no endorsement of a technological imperative is intended. The framework is simply intended as a new lens that offers a new perspective on IT business value. On the one hand, the framework recognizes that IT impacts both operational processes and the management processes associated with their execution. The framework further acknowledges that such impacts occur along three dimensions. In applying the framework, an organization should identify the key operational and management processes that contribute to achievement of strategic goals, and then consider the possible impacts of IT along automational, informational, and transformational lines.

Within this framework we are still presented with the difficulty of assessing the business value of specific IT *effects* on specific *processes*, e.g., an informational effect on procurement processes. It might be argued that we are still left with the task of explicitly measuring the actual business value of this effect. It could be further argued that operational and management processes are empirically inseparable, as are automational, informational, and transformational effects on these processes. However, we are not advocating the empirical assessment of the unique business value contribution of IT along each dimension. In a sense, our objective was to specify the object of measurement more precisely, which in itself is a significant step in clarifying the business value measurement issue. What we have achieved in our framework is a lowering of the microscope to bring about a closer linkage between the level at which the technology is deployed, the level at which the impact occurs, and the level at which it is measured. This reduces the possibility of dilution of actual impacts as a result of the measurement scheme. Moreover, we believe that the

proposed framework contributes to a richer understanding of the ways by which IT business value is created.

Regarding specific measures of business value, we argued earlier that these should be chosen by the individual firm in accordance with the specific objectives for which the technology is deployed. In this sense, a set of generic measures seems inappropriate. However, Table 2 describes a set of measures that have been successfully applied in a multi-firm study of IT business value (Kraemer, *et al.* 1994). This scheme forms the basis of a general IT business value measurement scheme. It may appear that these measures are simply variations of traditional measures of efficiency and effectiveness that continue to reflect the traditional output measures of “MIS impact” studies. Our primary argument in this paper has been for a move away from *firm-level* output measures, particularly financial measures, of business value in favor of process oriented measures. The metrics described in Table 2 are defined at the process level, rather than at the firm level. The metrics are dominantly reflective of an economic paradigm, and may appear to be overly rational to some readers. Again, our intention is not to propose a comprehensive measurement scheme, but to illustrate one application of the framework. We acknowledge that the measures are reflective of one of many value systems, and that a plethora of other metrics and value systems exist (Bakos 1987; Attewell 1991; Symons 1991).

4 Conclusions

The current literature offers many problems but few solutions to the task of assessing the business value of IT. Yet organizations cannot afford to continue to invest in IT on the basis of blind faith alone. Approaches to IT business value assessment that employ firm level output measures have resulted in conflicting accounts of IT’s impact, and virtually no insights into the processes by which IT creates value within business organizations. Deming (1986) states that “focus on outcome is not an effective way to improve a process or an activity”. Analogously, it is no way to study it either. Consistent with Attewell’s (1991) advice, that “only if we can first

understand the dynamics of IT and productivity inside economic organizations -- and answer these questions -- can we expect to reverse the productivity paradox..," this paper has advocated a process oriented approach to the study of IT business value. By synthesizing the extant literature on IT business value and the literature on IT-enabled process innovation, this paper has proposed a new framework for conceptualizing the business value impacts of IT. The framework is not an evaluative technique, but a lens that offers a new perspective on sources of IT business value within organizations, and thus provides a useful guide to those undertaking business value assessment. In addition, the framework can be used to develop a process oriented measurement scheme for IT business value. Ultimately, we hope that in supporting studies of IT impacts at the process level, the framework may give rise to an improved understanding of the value of IT to business organizations, and how it is achieved.

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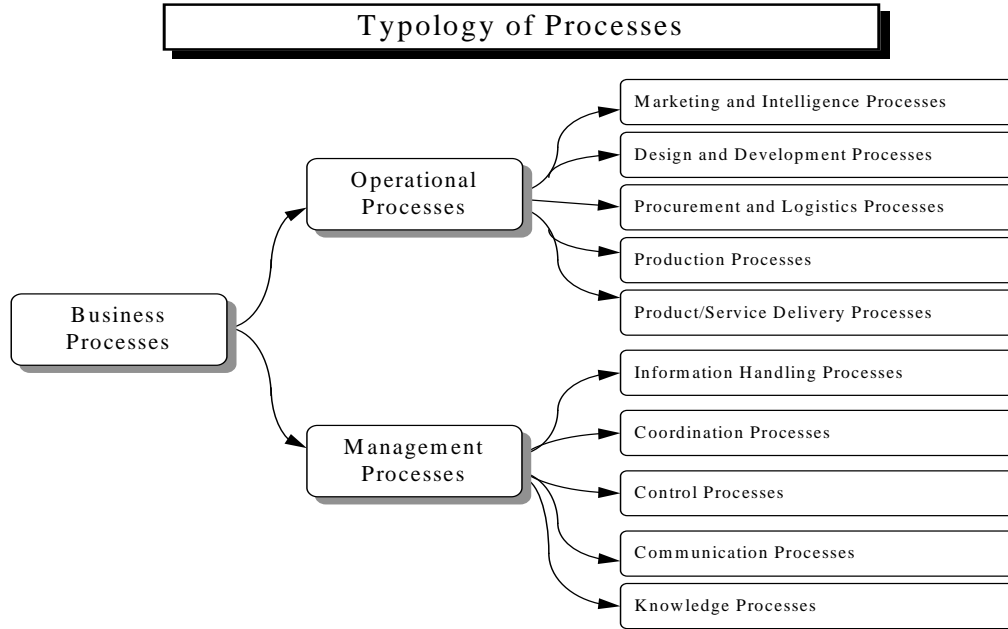


Figure 1: Typology of Business Processes

A Process Oriented Model of Business Value

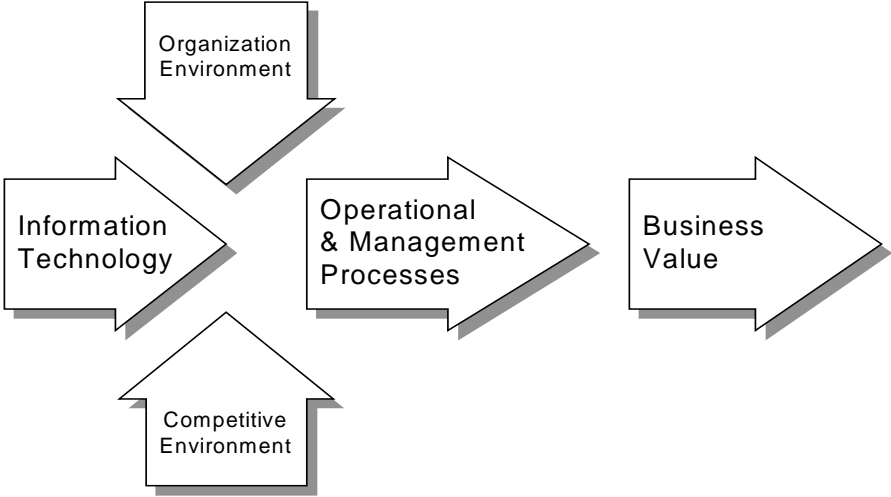


Figure 2: A process oriented model of IT Business Value

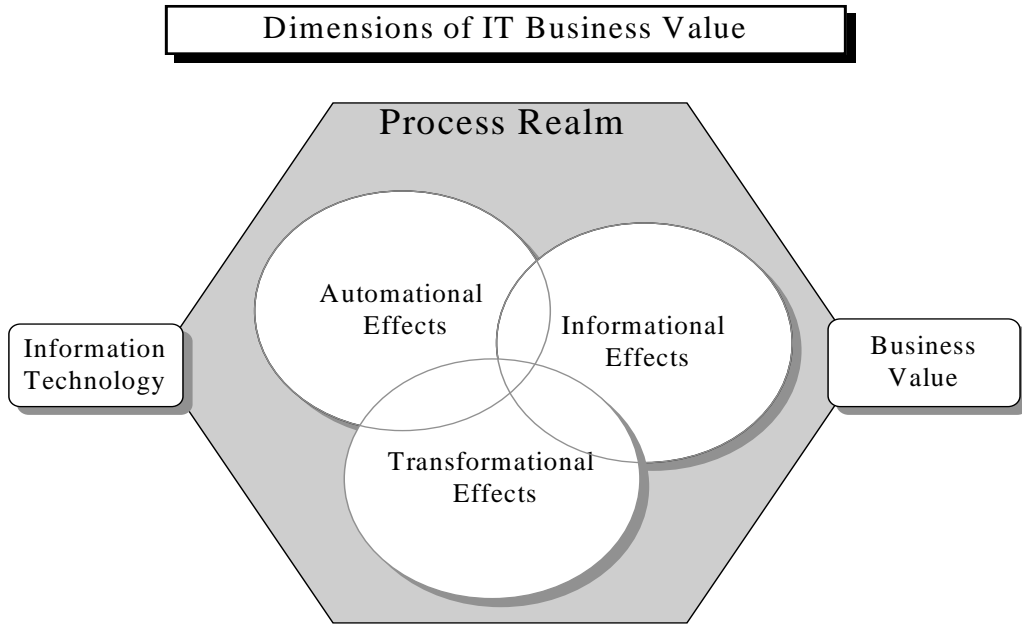


Figure 3: Dimensions of IT Business Value

Dimensions of IT Business Value			
Business Processes	<i>Automational</i>	<i>Informational</i>	<i>Transformational</i>
<i>Operational</i>			
<i>Management</i>			

Table 1: A Framework for Identifying Business Value Created Through the Impact of IT on Business Processes

Business Processes	Dimensions of IT Business Value		
	<i>Automational</i>	<i>Informational</i>	<i>Transformational</i>
<i>Operational</i>	Labor costs Reliability Throughput Inventory costs Efficiency	Utilization Wastage Operational flexibility Responsiveness Quality	Product and service innovation Cycle times Customer relationships
<i>Management</i>	Administrative expense Control Reporting Routinization	Effectiveness Decision quality Resource usage Empowerment Creativity	Competitive flexibility Competitive capability Organizational form

Table 2: Potential IT Business Value Metrics