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# The influence of ERP system implementation on the operational performance of an organization

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ABSTRACT

We investigate changes in operational performance that result from enterprise resource planning (ERP) system implementation. A literature-based and theory-driven model was developed to examine the relationship between ERP system implementation status and operational performance. Data were gathered through a field study to test the hypothesized relationships. The results indicate that the implementation of each ERP system module influences operational performance measures differently. In addition, the results highlight the varying influence of the implementation of the ERP system, as a whole, on operational performance measures. Our findings suggest that a better understanding of the contribution of ERP systems to operational performance can be obtained if researchers and managers assess changes in operational performance at both the modular and the system levels.



## 1. Introduction

The global market for enterprise resource planning (ERP) has registered significant growth in the last two decades (Bonasera, 2000; Mabert, Soni, & Venkataramanan, 2000; Reilly, 2005). The global ERP market's revenues were estimated at $65 billion in 2008, $61 billion in 2009, and $65 billion in 2010 (D'Aquila, Shepherd, & Friscia, 2009). Early ERP system implementers deployed modules that primarily addressed intra-firm activities in the finance, logistics, and human resources functions of the organization (Hernandez, 1998; Mabert et al., 2000; Meissner, 2000). As intra-firm ERP implementations stabilized, firms added modules that addressed inter-firm activities (Bendoly & Jacobs, 2005; Hendricks, Singhal, & Stratman, 2007; McGaughley & Gunasekaran, 2007). Because of expanding customer demand, ERP vendors continue to add to their product lines by offering ERP systems that have more depth, complexity, and modular integration.

Investment in ERP systems has been fueled by studies indicating that ERP system implementations result in improvements in operational performance (Cottelleer, 2006; Mabert, Soni, & Venkataramanan, 2001; McAfee, 2002). Mabert et al. (2001) and McAfee (2002) found that intra-firm ERP systems enable firms to standardize, integrate, and streamline their data and process flows. This also provides critical information streams necessary for effective decision-making. Firms fine-tune their installations over time and leverage ERP information to effect improvements in areas such as inventory management and order management. Firms typically add modules that extended the ERP system beyond the enterprise to include suppliers and customers. The ongoing process of stabilizing, fine-tuning, and extending ERP systems has been found to further improve operational performance (Bendoly, Rosenzeig, & Stratman, 2009; Gattiker & Goodhue, 2005; Stratman, 2007).

With the constant growth in scope and level of sophistication of ERP systems, there is increasing interest in the influence of these systems on operational performance at the modular level and at the systems level. Researchers such as Gattiker and Goodhue (2004), Cotteleer and Bendoly (2006), and Stratman (2007) note that an ERP system is much more than a mere collection of information processing modules that support various intra and inter-firm activities. They argue that a systemic concept (i.e., of, and pertaining to, a system) underlies ERP system modules and that the connections and interdependencies among the modules improve operational performance. Past research further suggests that, over time, operational performance improves as employees use the ERP system in different and sometimes unique ways to enhance organizational tasks and processes (Chou & Chang, 2008; Gattiker & Goodhue, 2005; McAfee, 2002; Poston & Grabski, 2001). In this study, we seek to advance this stream of research by first examining whether the implementation status of each ERP module influences operational performance. Then, we investigate whether the implementation status of an ERP system as a whole (a collection of modules that addresses intra and inter-firm activities) influences operational

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performance. We believe that our investigation of individual and systemic ERP implementations can provide an improved picture of the value of an ERP system to a firm.

The rest of the paper is organized as follows. In Section 2, we examine the theoretical approach that underlies systemic ERP implementations. In Section 3, we elaborate on the research model and postulate hypotheses. Section 4 describes the research methodology. In Section 5 we provide details on the analyses and report results. In Section 6, we discuss the findings, the implications, and the limitations of the study. Finally, Section 7, summarizes the study and suggests directions for future research.

## 2. Theoretical background

Evidence-based research that links ERP systems characteristics to operational performance measures has alluded to an underlying "systemic approach". However, a well-articulated theoretical rationale for the relationship is lacking. This is particularly true for research that addresses ERP systems implementation. In an effort to move the field forward, we begin our development by offering a theoretically anchored rationale for the relationship between ERP systems implementation and operational performance.

The systemic approach is rooted in general systems theory. According to this school of thought, systems (such as ERP systems) are characterized by a combination of interdependent parts (e.g., ERP system modules) that result in flows across these parts. Among the flows that link parts of a system, the flow of information is viewed as the most critical (Scott, 2003). Hence, an understanding of information flows is necessary to exploit the strength of each of the parts (i.e., ERP modules) and the system as a whole (i.e., the ERP system).

Organizational information processing theory (OIPT), a specific contingency approach that also has roots in general system theory, was developed to explain the information processing phenomena (Galbraith, 1973, 1974, 1977; Huber, 1990; Knight & McDaniel, 1979; Tushman and Nadler, 1978). We concur with prior ERP research (Chou & Chang, 2008; Gattiker & Goodhue, 2004, 2005) that OIPT is an appropriate theoretical lens that takes a systemic approach to explore ERP system implementation and its influence on operational performance. The ensuing discussion uses OIPT as the theoretical underpinning of the relationship between ERP implementation and operational performance.

OIPT focuses on the limited ability of organizations to process information. Uncertainty is a central concept in the theory that drives the need for information processing. When uncertainty is low, firms typically use four mechanisms to increase coordination among interdependent organizational tasks – hierarchy of authority, rules and programs, planning and goal setting, and narrow span of control. However, when uncertainty is high, firms tend to address it in two ways. One approach is to reduce the need for information that is processed through the use of slack resources, self-contained tasks, or environment management. The other approach is to increase the capacity to process information through the use of information systems (IS) or lateral relations (Galbraith, 1977). Low uncertainty environments are an anomaly in today's world (Galbraith, 2000, 2002) and hence our focus will be on the choices that ERP systems afford the firm in high uncertainty environments.

Prior research has typically examined ERP system implementation using early OIPT approaches (Galbraith, 1973, 1974, 1977) wherein IS was considered one of the options available to firms to increase their capacity to process large amounts of information while reducing the number of exceptions that overload the hierarchy. However, Galbraith's later studies (Galbraith, 1994, 2000, 2002; Galbraith, Downey, & Kates, 2002; Galbraith, Lawler, & Associates, 1993; Mohrman, Galbraith, Lawler, & Associates, 1998) acknowledge the pervasive role played by IS in both reducing the need for information processing as well as increasing the capacity of firms to process information. In this study, we use Galbraith's later IS-based OIPT approach to discuss how ERP systems (modular as well as holistic) offer firms strategic options to reduce the need for information processing and/or increase the capacity to process information. In addition, we explore ERP research that attempts to tie such information processing advantages to the operational performance of the firm.

### 2.1. Reducing the need for information processing

High environmental uncertainty tends to increase the number of exceptions referred up the hierarchy. This overloads the firms' coordination mechanisms and prompts managers to look for ways to reduce the information needed to coordinate activities. Firms can act in three ways to reduce the information that is processed – create slack resources, create self-contained tasks, or manage their environment.

#### 2.1.1. Creation of slack resources

Firms can reduce the number of exceptions by simply reducing their performance levels (Galbraith, 1977; Scott, 2003). For example, firms could increase their order delivery time. The longer the delivery time, the higher will be the probability that firms can complete the job on time. The longer delivery times also permit the creation of work-in-process inventories that act as a buffer against machine breakdowns, quality rejects, etc. Thus, fewer exceptions will arise, less information needs to be processed, and the exceptions can be handled by the existing hierarchies. However, reducing performance levels consumes more resources (for example, longer delivery times generate work-in-process inventories which, in turn, absorb capital that could be put to better use). It is also possible that this could have a negative influence on customer satisfaction. Hence, these slack resources could represent substantial costs to the firm.

An ERP system can reduce or obviate the need for firms to use slack resources. ERP systems provide access to a vast amount of real-time managerial information (for example, resource status such as inventory, or product development status, and hence delivery times). Cotteleer and Bendoly (2006) observe that, over time, firms fine-tune their ERP systems and leverage supply chain information to effect improvements in operational performance in areas such as order delivery time. Bendoly et al. (2009) suggest that firms which efficiently use ERP-sources information enhance operational performance in areas such as process standardization and on-time delivery performance.

#### 2.1.2. Creation of self-contained tasks

The creation of self-contained tasks emphasizes the use of groups or units to handle projects, products, processes, customers, etc. This eliminates the use of shared resources, reduces the division of labor, and results in the point of decision being moved closer to the source of information (Galbraith, 1977, 2000, 2002; Scott, 2003). For example, a self-contained unit could have its fabricating and assembly operations, its own testing facilities, etc. This reduces scheduling conflicts, and improves delivery times. There are, however, costs associated with the use of self-contained groups such as a reduction in skill specialization, and costs associated with the division of labor.

Firms can configure their ERP systems to facilitate the use of self-contained units. Markus, Tanis, and Fenema (2000), and Koch (2001) suggest that firms can configure their ERP systems in different ways at the operational level, the business activity level, and the business process level. For example, firms that implement