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The impact of organization size on enterprise resource planning (ERP) implementations in the US manufacturing sector

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Abstract

Enterprise Resource Planning (ERP) systems have experienced a phenomenal growth in the last 5 years and at present they are pervasive in the US manufacturing sector. This paper describes an attempt to chronicle this phenomenon through a series of case studies and an extensive survey. Manufacturing companies ranging in size from a few million dollars in annual revenues to over a hundred billion dollars are included in this study. The key finding from this study is that companies of different sizes approach ERP implementations differently across a range of issues. Also, the benefits differ by company size. Larger companies report improvements in financial measures whereas smaller companies report better performance in manufacturing and logistics.

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1. Introduction

Today's global business environments are characterized by unprecedented competitive pressures and sophisticated customers who demand innovative and speedy solutions. Understanding and optimizing business processes is a cornerstone of success in these fast-changing environments. Global distribution channels, numerous international plant sites, and closely integrated sourcing arrangements have changed the way hundreds of companies do business. A key component of managing these organizations is Information Technology (IT). Over the past few years, many companies have embraced a new class of planning and resource management software systems to integrate processes, enforce data integrity, and better manage resources. These package systems are broadly classified as Enterprise Resource Planning (ERP) systems.

ERP systems, which evolved from Materials Requirements Planning (MRP) and Manufacturing Resource Planning (MRP II) systems, are expected to provide, at least in theory, seamless integration of processes across functional areas with improved workflow, standardization of various business practices, improved order management, accurate accounting of inventory, and better supply chain management. The Gartner Group coined the term ERP in the early 1990s to describe these systems and stipulated that such software should include integrated modules for accounting, finance, sales and distribution, human resources, materials management and other business functions based on a common architecture that links the enterprise to both customers and suppliers.

According to industry reports at least 30,000 companies worldwide have implemented ERP systems. The vast majority of these implementations have taken place in the mid-1990s to 2000. Thus, these systems are relatively new with very little research available concerning their implementation, their operations or their impact. Like many emerging areas, the initial research consisted

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primarily of case studies and articles in the business press or practitioner-oriented journals. Many of these articles tended to be in terms of anecdotal information based on a few successes or failures. As a result, initial information on ERP often tended to be contradictory and skewed to fit certain points of view. Also, these articles tended to be general whereas our interest was to gather data in a more systematic manner concerning the implementation of such systems in manufacturing companies.

To better understand and guide this process, the authors adopted a two-phased approach to analyze ERP adoption and implementation experiences in the manufacturing sector. In the first phase, a case study approach was used to study 12 different manufacturing ERP implementations. These implementations were studied using structured interviews of key managers, IT professionals, and users associated with each company's implementation. In addition, senior consultants at six consulting firms specializing in ERP implementations were interviewed at length to get their perspectives on ERP [1,2]. The primary objective of the case studies and the consultant interviews was to obtain reliable and detailed information on the current status of ERP practice and implementations in the manufacturing sector.

Two key issues emerged from this phase of the project. First, companies of different sizes tended to do different things in their implementations. In particular, there were distinct differences between small and large companies over a range of issues. These differences included: (1) the motivation to go with an ERP system; (2) the different systems adopted; (3) the implementation strategies; and (4) the degree of reengineering and customization of the base system. And second, there were differences in the outcomes and benefits attained. While the case studies proved useful in understanding the general nature of these differences, this part of the study was based on a small sample. To confirm our initial findings, a survey of a larger sample of companies was undertaken in the second phase of the project in order to obtain a broader perspective of ERP practice and experiences relating to adoption, selection of systems, customization, costs, and performance, and success factors across different sized companies. More specifically, the primary objective of this project is to study the impact of the organization size on ERP adoption and implementation.

The relationship between structural variables of an organization such as size, industry type and organizational structure, and their impact on various operations has been studied for a long time [3–5]. Organizational size is the most frequently examined structural variable and has been used to study issues relating to innovation, R & D expenditures and market power [6–8]. The impact of company size on adoption, implementation and use of information technologies has received increasing attention in the recent academic literature as well [9–12]. Gremillion conjectures a lack of relationship between the size and usage. Additionally, several papers [8,11,13] suggest that larger companies

are more likely to be early adopters of information technology innovations.

In the Operations area, several studies of manufacturing firms indicate that organization size plays a critical role in terms of the level of adoption and use of technologies [14–18]. These findings show that in general small manufacturers tend to lag behind large manufacturers in implementing new technologies, plus employ different practices. ERP implementations have followed similar trends. While larger companies were the first movers to ERP systems in the mid-1990s, today smaller companies view this approach as an important management tool. Increasingly, many mid-size and smaller companies are either implementing or planning to implement ERP systems [1].

The research reported here provides an insight into some of these critical issues outlined above. In the next section, we discuss the relevant research germane to this evolving area and the research methodology employed to conduct the investigation. Section 3 describes the initial data collection field study, initial observations and five research propositions. Section 4 outlines in detail the mail survey steps used for a more extensive and systematic data collection effort, and testing of the propositions. Section 5 presents other observations and insights gained from both the case studies and the survey, with the final section highlighting our conclusions.

2. Research issues and research framework

Despite the implementation of ERP systems since the mid-1990s, academic research in this area is relatively new. It is only recently that researchers have dealt with various aspects of ERP in a more systematic manner. The initial thrust of many of these articles has been in the implementation area. Davenport [19] in an early ERP article looked at the reasons for implementing ERP systems and the challenges of the implementation project itself. Van Everdigen et al. [20] surveyed 2647 European companies across all industry types to determine adoption and penetration of ERP by functionality. Mabert et al. [1] used a hybrid approach with a series of case studies followed by a survey to study penetration of ERP systems, motivation, implementation strategies, modules and functionalities implemented, and operational benefits as they apply to the US manufacturing sector. Adam and O'Doherty [21] used case studies to study ERP implementations in small and medium enterprises in Ireland.

More recently, several researchers have dealt with organizational issues either regarding implementation of ERP systems or performance and benefits of ERP systems. Abdinnour-Helm et al. [22] look at pre-implementation attitudes and organizational readiness for implementing an ERP system. They conclude that extensive organizational investments in shaping pre-implementation attitudes do not always achieve the desired effects. Stratman and Roth [23] develop and operationalize eight organizational

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