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The relationships among virtual enterprise, information technology, and business performance in agile manufacturing: An industry perspective

Shad Dowlatshahi, Qing Cao *

*Division of Business Administration, HW Bloch School of Business and Public Administration,
The University of Missouri-Kansas City, 5110 Cherry Street, Kansas City, MO 64110-2499, USA*

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Abstract

Agile Manufacturing (AM) is a manufacturing paradigm that focuses on smaller scale, modular production facilities, and agile operations capable of dealing with turbulent and changing environments. From several enablers of AM, Virtual Enterprise (VE) and Information Technology (IT) were chosen. This empirical study explored the impact of the alignment between VE and IT on business performance in an AM setting for five different industries. Extensive data collection strategy and several tests were used to establish the reliability and validity of the data collected. Extensive analyses of the data using Structural Equation Modeling were performed for five hypotheses across five different industries. The results indicate that both VE and IT had positive influences on business performance for all industries. It was also established that the alignment between VE and IT had a positive impact on business performance for all industries. Further, it was shown that the impact of the alignment between VE and IT on business performance was more significant than the impact of VE and IT on business performance individually for all industries. The statistical analyses and results showed that there were no significant differences among the industries surveyed. At the bivariate level of analysis, some minor differences for one industry were highlighted. In conclusion, the assessment of the results along with future research directions is provided.

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Keywords: Agile manufacturing; Virtual enterprise; Information technology; Business performance; AM industries

* Corresponding author. Tel.: +1 816 235 6242; fax: +1 816 235 6506.
E-mail address: caoq@umck.edu (Q. Cao).

1. Introduction

Global competition has brought about changes that are characterized by product proliferation with shorter and uncertain life cycles, innovative process technologies, and customers who simultaneously demand quick response, lower costs, and greater customization. Companies must cope effectively with continuous and unexpected changes in order to become competitive. The ability to respond quickly and effectively (time-based competition) and to satisfy customer needs has become a defining characteristic of competitiveness for many manufacturing companies.

Mass production, despite improvements made by just-in-time and lean production strategies, is essentially a system favoring large-scale and hierarchical corporate structures. Agile Manufacturing (AM) is an emerging manufacturing paradigm, which considers agility a key concept necessary to survive against competitors under an unexpectedly turbulent and changing environment. The AM suggests that smaller scale, modular production facilities, and cooperation between enterprises would be the principal pattern of competitiveness for the next generation (Goldman et al., 1995; Sahin, 2000).

Several enablers of AM were identified conceptually in the AM literature (Sharp et al., 1999; Gunasekaran, 1999; Yusuf et al., 1999; Sharifi and Zhang, 2000, 2001). According to Sharp et al. (1999), AM enablers include core competencies, Virtual Enterprise (VE), rapid prototyping, concurrent engineering, multi-skilled and flexible people, continuous improvement, team working, change and risk management, Information Technology (IT), and empowering. Based on an extensive literature review, Gunasekaran (1999) proposed a research framework for the design of agile manufacturing systems that included four dimensions: strategies, technology, people, and systems. Gunasekaran (1999) argued that VE is one of the key strategies needed to achieve agility in manufacturing. He further stated that “agile-enabling technologies such as Internet, multimedia, EDI, electronic commerce . . . need to be suitably incorporated within the scope of VE in order to achieve agility in manufacturing (Gunasekaran, 1999, pp. 100–101).” Yusuf et al. (1999) attempted to identify the drivers of AM. They claimed that the core drivers of AM include VE, core competence management, capability for reconfiguration, and knowledge-driven enterprise. They further pinpointed the fact that IT (i.e. EDI) plays a major role in VE. Technological capabilities, especially IT, were also viewed by other AM researchers as major agility drivers (Sharifi and Zhang, 2000, 2001). Other AM literature also recognized the relationship between IT and VE (Martinez et al., 2001; Khalil and Wang, 2002). According to Martinez et al. (2001), VE is supported by the extensive use of information and communication technologies. Khalil and Wang (2002) argued that advanced IT has made it possible to manage the complexity of a VE environment more efficiently and effectively. This study focuses on two of the AM enablers, namely, VE and IT. The VE and IT seem to represent the common thread and consensus of many works as the most relevant enablers of the AM. This study further explores the relationship between VE and IT and their alignment on a firm’s business performance in an agile manufacturing environment.

2. Review of literature

Why do we know so little about the impact of VE and IT on firms’ business performance within the context of AM in the literature? To provide answer for this question, the definitions, basic information, and review of literature for AM, VE, and IT are presented next.

2.1. Agile Manufacturing (AM)

The concept of agility has received a great deal of attention by AM researchers and practitioners alike. Although a number of definitions for agility have been given, a common thread focuses on being able to

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