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# Enhancing Electronic Commerce By Implementing Agile Manufacturing: An Empirical Study In The Manufacturing Sector

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## Introduction

Electronic commerce (EC) is emerging as a driving force in today's economy. According to Forrester Research Institute (1997), the estimated sales in electronic commerce would rise from US\$1 billion in 1995 to US\$117 billion by the year 2006. EC activities are ranging from shopping to manufacturing (Shaw et al., 1997). This research is specifically focused on compatibility issues of operational strategies used in the manufacturing sector of electronic commerce. Electronic commerce is changing manufacturing systems from mass production to demand-driven and possibly customized, just-in-time manufacturing (Turban et al., 2000, Kalakota, R. et al., 1996). In electronic commerce, as product life cycle becomes shortened, high product quality becomes necessary for survival, markets become highly diversified and global, and continuous and unexpected change becomes the key factor for success. The ability to respond quickly and effectively to satisfy customers has become a defining characteristic of competitiveness for manufacturing companies in the electronic commerce era. Agile manufacturing is an emerging new manufacturing paradigm, which considers agility a key concept necessary to survive against competitors under an unexpectedly turbulent and changing environment (Goldman et al., 1995). Thus, agile manufacturing is a viable operational choice for the manufacturing companies in electronic commerce. As Shaw et al. (1997) point out that a key feature of electronic commerce research as a distinct discipline is its multidisciplinary perspective. This study is exploring electronic commerce research from both MIS and OM perspectives.

## Literature review

According to Cho et al. (1996), agile manufacturing can be defined as the capability of surviving and prospering in a competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets, driven by customer-designed product and services. Agile manufacturing will meet the changing market requirements by suitable alliances based on core-competencies, organizing to manage change and uncertainty, and leveraging people and information (Goldman et al., 1995). In practice, many manufacturing companies have started to use agile manufacturing concept to gain and maintain competitive edge. For example, Dell Computer, leveraging its agile manufacturing with electronic commerce enables it to compress its supply chain and become much closer to its

customers (Maglitta, 1997). However, in MIS/POM arenas, research in both electronic commerce and agile manufacturing is in its infancy and empirical studies of linking agile manufacturing and electronic commerce are scarce (Cagliano et al., 2000). Moreover, agile manufacturing was not yet well defined and more work needed to be done to refine the concept (Burgess, 1994).

## Research questions

This study aims at extending existing manufacturing strategy model in coping with the electronic commerce and testing the revised model. The research questions are as follows: 1. Is agile manufacturing a strategic fit for a manufacturing company in electronic commerce to sustain its competitive edge? 2. What are the relationships among electronic commerce environment, competitive strategy, agile manufacturing strategy, and business performance? 3. Are agility enablers i.e. information system/technology major differentiators in implementing agile manufacturing in electronic commerce environment?

## Theoretical foundation

The manufacturing strategy model initially developed by Skinner (1969) is the predominant conceptual models of manufacturing strategy in POM and serves as the theoretical foundation of this paper. The model (Fig. 1) prescribes in detail the links among environment dynamism, competitive strategy, and manufacturing strategy to achieve good business performance. Environment dynamism refers to the degree of turbulence in products, technologies, and the demand for products in a market. Competitive strategy refers to the broad dimensions that a business uses as a basis of advantage, e.g., price vs. differentiation (Port, 1980). Manufacturing strategy means order winner manufacturing dimensions (Hill, 1994), e.g., quality and cost. Performance can be measured by sales growth and market share. A contemporary review by Anderson et al. (1989) reveals that this finding holds true. More recently, Ward et al. (2000) empirically test the manufacturing model using a sample of manufacturers in three industries in the United States. Their findings support the manufacturing strategy model.

## Research model and procedure

This research extends the manufacturing strategy model to electronic commerce environment. Fig. 2 shows the conceptual model for this study. Electronic commerce characters represent the environment dynamism that changes the scope of the way companies do businesses (Turban et al., 2000, Min et al., 2000, Poon et al., 1999, Shaw et al., 1997, Strader et al., 1997, Kalakota et al., 1996). This independent variable construct includes the rate of changes caused by electronic commerce shown as follows:

1. The rate at which products become outdated
2. The rate of innovation of new products
3. The rate of innovation of new operating process, e.g., reconfiguration
4. The tastes and preferences of customers.

Competitive strategy construct consists of both price and differentiation dimension. According to Berry et al. (1999), agility is becoming the sole manufacturing strategy that wins orders and other conventional manufacturing strategies such as cost and quality are order qualifiers (Hill, 1994). As such, we only consider the agile manufacturing strategy in the revised model. Drawn upon agile manufacturing literature, the agile manufacturing strategy involves responsiveness, competency, flexibility, and speed (2000, Berry et al., 1999, Yusuf et al., 1999, Sharp et al., 1999, Gunasekaran, 1999). Performance construct (dependent variable) can be measured by company' market share and sales growth.

In this research, we also add the agility enabler as a moderator into the model that affects the agile manufacturing strategy. A moderator is a variable that affects the direction and/or strength of relation between an independent or predictor variable and dependent variable. The agility enablers are the tools that help a manufacturing company enhance the agility manufacturing strategy (Berry et al., 1999, Yusuf et al., 1999, DeVor et al., 1997). The model suggests that changes caused by electronic commerce affect both competitive strategy and agile manufacturing strategy. Competitive strategy is a mediate variable because it intervenes between changes and agile manufacturing strategy. The model also implies that competitive strategy directly influences agile manufacturing strategy and it also suggests that the relationships of environment, competitive strategy, and agile manufacturing strategy is linked to performance.

## Methodologies

This research will use both case study and survey methodologies (i.e., triangulation). Case study methodology is used for two reasons: 1. There is a need to extend the contemporary agile manufacturing research framework to electronic commerce arena. 2. There is little empirical research in both agile manufacturing and electronic commerce. The case study design is advocated

by a number of researchers for situations such as this (Flynn et al., 1990, Lee, 1989). We are in the process of conducting two case studies (Company A and B) for exploratory and descriptive purposes. The results from these explorative case studies will help us to better understand the research questions we are pursuing and also help us in developing our instruments for the actual case studies and survey.

After the exploring stage, a preliminary questionnaire will be distributed to key employees who participated in the case studies. This pilot study is intended to refine the questionnaire and the results of the pilot study will also help us to further enhance the case study and survey instruments. A full-fledged worldwide survey will then be conducted to gather responses from operation managers in the manufacturing companies involved in electronic commerce. The responses will be collected and evaluated to determine the impact of agile manufacturing on electronic commerce in the manufacturing sector and also to assess the impact of various agility enablers and strategies on agile manufacturing strategy. Structured Equation Modeling will be used for the statistical analysis. Case studies will then be conducted to supplement and complement the survey results. The intention is to provide as holistic a picture as possible on this research issue.

## Contributions and conclusions

This research explores the electronic commerce research issues from both OM and MIS perspectives. It provides several contributions to both operations management and MIS fields. First, it extends the manufacturing strategy model in the context of electronic commerce. Second, this research presents a better-defined agile manufacturing – the new manufacturing paradigm. Third, this is the first study in operationalizing agile manufacturing in coping with electronic commerce environment.

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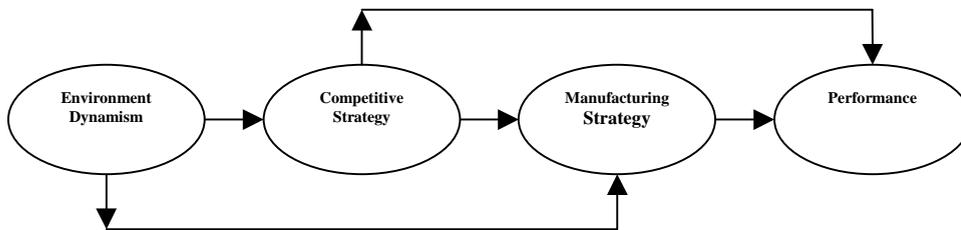
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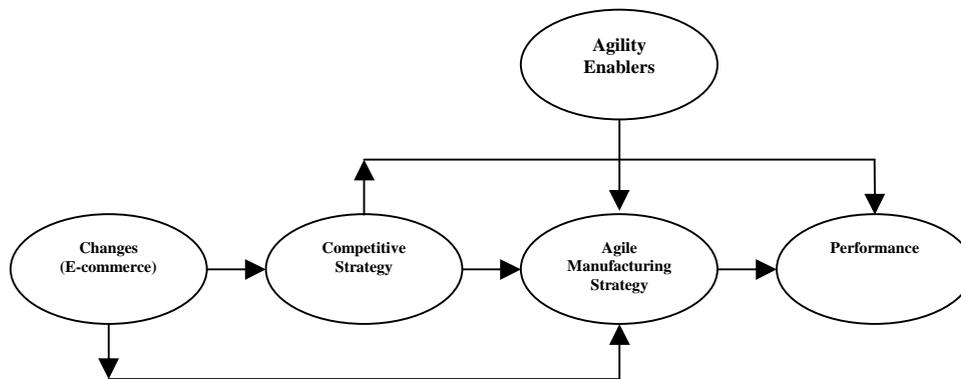
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**Fig. 1: Model of manufacturing strategy**



**Fig. 2: Model of agile manufacturing strategy in electronic commerce**