

Change drivers in the new millennium: implications for manufacturing strategy research

Caron H. St. John^{a,*}, Alan R. Cannon^{b,1}, Richard W. Pouderr^{c,2}

^a Department of Management, Clemson University, 101 Surrine Hall, P.O. Box 341305, Clemson, SC 29634-1305, USA

^b Department of Information Technology & Operations Management, Appalachian State University, Boone, NC 28607, USA

^c Department of Management, Appalachian State University, Boone, NC 28607, USA

Abstract

Drawing on multiple sources, we identify technological, global and workforce trends that will affect the formulation and implementation of manufacturing strategy in the next decade. We then describe several theories from economics, sociology, and psychology and show how they can be used to enrich our interpretations of the effects of these trends. Throughout, we offer suggestions for future research in manufacturing strategy. © 2001 Elsevier Science B.V. All rights reserved.

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1. Introduction

At the dawn of the new millennium, several emerging and continuing trends point to a variety of fundamental changes central to manufacturing strategy. Many of these changes are technologically driven, and in some cases today's firms are already grappling with their effects. The rush to embrace and exploit supply chain management, for example, reflects both the increased penetration of inter-organizational information technology and the increased competitive pressure of today's markets. Other changes, such as shifts toward collaborative, knowledge-based work environments, have only just begun to take root in firms worldwide and may not reach their full impact until well

into the next decade. And, we should note, some of the changes promised by the new millennium may remain just that — promises.

Realized or not, however, these developments likely will result in order-of-magnitude increases in the uncertainty and complexity of manufacturing strategy formulation and implementation. The new millennium promises more demanding customers, greater competitive intensity, and increased complexity in production technology and coordination. What are the implications of these changes for the development of manufacturing strategy?

In this paper, we explore the predicted changes from several perspectives, using selected theories from economics, sociology, and psychology. In doing so, we hope to expand our understanding of the implications of these trends, and to identify research directions for manufacturing strategy researchers. The paper is organized as follows. In the first section, we synthesize predictions about trends that are affecting manufacturing firms. Second, we describe several theories from economics, sociology, and psychology

* Corresponding author. Tel.: +1-864-656-5963; fax: +1-864-656-2015.

E-mail addresses: scaron@clemson.edu (C.H. St. John), cannonar@appstate.edu (A.R. Cannon), pouderrw@appstate.edu (R.W. Pouderr).

¹ Tel.: +1-828-262-2034; fax: +1-828-262-6190.

² Tel.: +1-828-262-2163; fax: +1-828-265-8685.

that have been used only sparingly in manufacturing strategy research, then use the theories to provide a richer interpretation of the emerging trends in operations. We then conclude with some suggested research questions for manufacturing strategy researchers.

2. Key trends driving change within manufacturing

In 1997, the Agility Forum, with sponsorship from the National Science Foundation, published *Next-Generation Manufacturing: A Framework for Action* (Hughes, 1997). The four-volume publication documented the results of the Next-Generation Manufacturing (NGM) Project, which involved individuals from more than 100 companies, industry associations, academic institutions, and government agencies (see Table 1 for a list of participating individuals). As the project leaders noted in their summaries, advancements in technology are allowing critical business information to be available around the world instantaneously. Decision-makers can communicate with each other from any place at any time. These technology advancements are making time zones, national boundaries, and the physical location of management increasingly unimportant. Furthermore, improvements in transportation and increasing standards of living in most nations of the world are making the physical location of manufacturing facilities less important than in the past. Finally, as customers become more educated and improve their standard of living around the world, they will become more demanding of manufacturers.

The project task force summarized the drivers of change within manufacturing as follows: (1) ubiquitous availability and distribution of information, (2) accelerating pace of change in technology, (3) rapidly expanding technology access, (4) globalization of markets and business competition, (5) global wage and job skills shifts, (6) environmental responsibility and resource limitations, and (7) increasing customer expectations (Hughes, 1997, p. 3). Similar observations have been made by others, as well. In a survey of CEOs of US firms, almost 90% of those CEOs surveyed labeled “improving knowledge management and the use of information technology” as major trends at century’s end (National Institute of Standards & Technology, 1998).

What, specifically, will these changes mean for manufacturing? These more sophisticated and readily available information technologies allow firms to combine mechanisms for collecting information about customers (i.e. user profiles from e-commerce transactions, scanner data) with data mining and neural networks for pattern recognition, which will allow deeper understanding of customer behavior and more accurate forecasting. Lower cost, more sophisticated computer-integrated manufacturing techniques will allow more manufacturers to move toward mass customization. Advances in rapid prototyping processes will move that technology from predominantly a design tool to a tooling and production technique, which will also facilitate mass customization. Increased use of simulation testing of new products will allow much more rapid new product launch.

Web communications and web commerce will make new products known to a world market immediately. These technologies, working in concert, will collapse the time-span between the idea for the product and market launch to days, not months or years. Already firms are using CAD/CAM technology to facilitate rapid reproduction of their competitors’ products (Quick, 1999), shrinking the window during which successful innovations can be exploited. Consequently, products will saturate the market and reach maturity much faster as informed, on-line customers react quickly to new product announcements. From the point of view of operations, these trends have implications for design-manufacturing integration (Cohen and Apte, 1997; Hauptman and Hirji, 1999; Hughes, 1997), dynamic capacity planning and scheduling, management of supplier networks, and workforce coordination across cultural and language barriers (Hauptman and Hirji, 1999).

In light of these technology and globalization trends, integrating activities both within and beyond organizational boundaries has become a major challenge at century’s end and will likely continue for the foreseeable future (Mabert and Venkatraman, 1998). Integration efforts are expected to be focused both on internal activities, such as product and process design, and on fostering extra-organizational linkages with customers and suppliers. The explosion of interest in supply chain management in the last 2 years is evidence of this trend and its perceived importance in the current and future competitive environment.

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