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Int. J. Production Economics 95 (2005) 27–38
international journal of production economics
www.elsevier.com/locate/dsw

Improving trade-offs in manufacturing: Method and illustration

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Received 1 November 2002; accepted 1 October 2003

Abstract

The analysis of trade-offs between competitive priorities is one of the core issues in manufacturing strategy research. However, past studies focused mainly on empirical validation of the trade-off concept. There has been limited research on practical aspects of trade-off management, especially methods for trade-off improvement and the incorporation of trade-off analysis into manufacturing strategy formulation. This study presents a heuristic method for the improvement of manufacturing trade-offs. The method incorporates the concepts of dynamic trade-offs and improvement trajectories into a decision-making process. An example of implementation is given, based on the case of a British manufacturer.

Keywords: Competitive priorities; Performance; Manufacturing strategy; Decision analysis

1. Introduction

The analysis of trade-offs between competitive priorities is one of the core issues in manufacturing strategy research (Skinner, 1992). The traditional trade-off paradigm indicates that raising one aspect of performance imply reductions in some other aspect (Slack, 1997, p. 227). Therefore, companies must prioritize their competitive objectives and devote resources to improve performance in the main objectives (Boyer and Lewis, 2002).

Over recent years, research on manufacturing trade-offs has mainly focused on empirical validation of the concept. Several studies performed correlation analyses of competitive priorities in manufacturing companies to determine whether trade-offs such as cost versus quality and speed versus flexibility were real (Boyer and Lewis, 2002; Filippini et al., 1995; Schroeder et al., 1996; Mapes et al., 1997). Despite having different results, they produced relevant knowledge on the nature and impact of trade-offs in manufacturing. However, there has been considerably less effort to develop knowledge on practical aspects of trade-off management such as how to improve trade-offs and how to incorporate trade-off analysis into the manufacturing strategy process.

This study attempts at filling that research gap through providing a heuristic method to improve trade-offs in manufacturing. The method departs with research suggesting that trade-offs are dynamic and contingent on manufacturing strategy and structure (Hayes and Pisano, 1996; Schmenner and

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doi:10.1016/j.ijpe.2003.10.023

Swink, 1998). A dynamic perspective implies that trade-offs exist in manufacturing but can be changed by managerial action. A contingent perspective suggests that different trade-offs affect different operations, depending on aspects such as competitive priorities, technology choices, and capabilities.

2. Manufacturing trade-offs

It is possible to characterize three distinct stages in the history of trade-off research. The early manufacturing strategy studies viewed trade-offs as constraints to competitiveness. Trade-offs forced manufacturing operations to focus on a narrow set of objectives and tasks (Skinner, 1974; Hayes and Schmenner, 1978). For example, Skinner (1969) provided a list of trade-off choices regarding manufacturing structure and infrastructure. Miller (1983) suggested every plant had a specific mission such as low unit cost or high quality; management's role was to build the appropriate facilities, infrastructure, and labor to accomplish that mission. Their basic message was "you can't have it both ways" (Skinner, 1969, p. 141). An example of the traditional view was Hayes and Wheelwright's (1984, p. 40) suggestion that Mercedes-Benz's competitive advantage was achieved by providing high reliability on a standard product.

Studies in the 1980s and early 1990s challenged the traditional approach to trade-offs. They departed with evidence from firms that seemed to outperform competitors in different areas simultaneously. The "World Class Manufacturing" school suggested there were no trade-offs but only complements between competitive priorities (Collins and Schmenner, 1993). That school was mainly represented by Schonberger (1986), who suggested that trade-off was a myth—the application of just-in-time and Total Quality Management principles allowed manufacturers to be good in all areas of performance such as flexibility, quality, delivery, and cost. Womack et al. (1990, pp. 51–53) provided a fitting example, indicating that Toyota had the ability to outperform competitors simultaneously in quality and cost due to fast setups and high labor motivation.

The contrasting ideas motivated a debate in the 1990s on the validity of trade-offs in manufacturing. That research can be divided in two streams. First, a series of survey studies analyzed correlations between competitive priorities in manufacturing to investigate which trade-offs were real (Boyer and Lewis, 2002; Filippini et al., 1995; Schroeder et al., 1996; Mapes et al., 1997). They often had different results (Dostaler, 2000). For example, Schroeder et al.'s (1996) analysis of 120 manufacturers in Japan, Italy, and the US found negative correlations involving the "attribute quality" measure. However, Mapes et al. (1997) suggested that the only trade-offs in their sample of UK Best Factory Awards involved "product variety". Taken as a whole, empirical studies appeared to indicate that trade-offs were contingent on manufacturing strategy and organizational aspects such as country of origin, competitive priorities, and capabilities.

The second research stream involved conceptual and case-based studies exploring the nature and sources of trade-offs in operations. They made at least three major contributions to understanding trade-offs in the manufacturing context. First, they indicated that trade-offs were "dynamic", in the sense that they were real but could be improved in operations (Skinner, 1992; New, 1992). Slack (1991) illustrated the improvement idea using the model of a pivot underneath the trade-off: investments in operations resources and capabilities raised the pivot to elevate simultaneously two or more performance variables. For example, better setup methods simultaneously improved the speed and flexibility of operations. The key to trade-off management was to build a set of resources and capabilities to improve different performance variables.

The second major idea was that improving trade-offs required the sustained, coordinated implementation of a series of improvement initiatives. Ferdows and De Meyer (1990) proposed the sandcone model, which indicated a sequence such as quality, dependability, flexibility, and cost to build capabilities and eliminate trade-offs. Hayes and Pisano (1996) stressed the role of improvement trajectories to enable sustainable improvements in different performance