Journal of Operations Management 19 (2001) 23–37

JOURNAL OF OPERATIONS MANAGEMENT

www.elsevier.com/locate/dsw

Understanding managerial preferences in selecting equipment

Gary Stading [a,*], Benito Flores [b,1], David Olson [b,2]

[a] *Department of Industrial Distribution, Texas A&M University, College Station, TX 77843-3367, USA*
[b] *Department of Information and Operations Management, Texas A&M University, College Station, TX 77843-4217, USA*

Received 13 September 1999; accepted 11 April 2000

Abstract

Industry continues to look for methods of gaining competitive advantage through manufacturing techniques. These techniques, however, can be matched by competitors if used without the guidance of a strategic framework. Similarly, structural capacity choices can be matched by competitors without the infrastructural benefits of a well defined operations strategy. In this study, multiattribute utility (MAU) theory analysis was used in an experiment to quantify the contribution of various structural and infrastructural strategic factors toward sustaining competitive advantage within the context of a capital equipment selection decision. The experimental respondents were manufacturing managers and professionals from the plastics industry. This research provides groundwork for understanding the role of strategic infrastructural factors in sustaining competitive advantage within the structural capacity decision of selecting capital equipment in the plastics industry.

Keywords: Capacity management; Empirical research; Measurement and methodology; Operations strategy; Multiattribute utility analysis

1. Introduction

An equipment purchasing decision impacts the capacity levels of a business (Persson, 1991). Oversized equipment selections can be costly in multiple ways including the initial outlay of cash and the subsequent result of having too much capacity (generating excessive inventories, idle equipment, etc.). Alternatively, undersizing equipment can result in greater penalties if lack of capacity constrains meeting customer demands (Markland et al., 1998). Equipment selection also has broader implications. For instance, the strategy adopted in selecting equipment can affect the flexibility of switching between products or ramping up products (Skinner, 1996).

Hayes (1985) argued that strategic infrastructural factors are the key to achieving competitive advantage. Skinner (1996) argued more specifically that strategic infrastructural factors in a capacity decision are an important source of competitive advantage. Capital investments have been viewed as strategic decisions (Lindberg et al., 1988; Persson, 1991). Capital equipment decisions based on engineering cost–benefit analysis considering productivity factors have deep roots in the industrial community (Sage, 1983; Newnan, 1991). However, if, as is hypothesized by Skinner (1996), the strategic considerations of these capacity decisions do represent sources of competitive advantage, then the acquisition of capital equipment provides an opportunity to gain sustainable competitive advantage.

* Corresponding author. Tel.: +1-979-845-4976.
E-mail addresses: stading@entc.tamu.edu (G. Stading), flores@tamvm1.tamu.edu (B. Flores), dolson@tamvm1.tamu.edu (D. Olson).
[1] Tel.: +1-409-845-4248.
[2] Tel.: +1-409-845-2254.

PII: S0272-6963(00)00047-4

This paper details an experiment which measures the effect of various structural and infrastructural factors in a capital equipment selection decision. The capital equipment decision is made under experimental hypothetical conditions. The objective for this scenario is to use the purchase of equipment to gain a sustainable competitive advantage. The subjects were asked to select and purchase production equipment, which would help them meet the competitive priorities facing their assigned business.

The experiment is designed to evaluate how managers value structural and infrastructural factors in selecting equipment configurations to meet their assigned competitive priorities. The competitive priorities are unique to each treatment of this experiment, and the experiment limits the subjects' choices in equipment selection to four alternatives. The equipment choices are all of equal capacity. The subjects have the choice of purchasing one large machine, two medium large machines, four medium small machines or eight small machines to meet the demands of the hypothetical task presented to them. The equipment options are equal on all other attributes and priorities not considered as tradeoffs in the study. The subjects are all practicing managers or professionals in the polymer processing industry. The experiment is designed to capture their expertise at competing in this marketplace.

2. Background

A manufacturing strategy is defined by the total pattern of management decisions made across the manufacturing system not just in relation to the capital expenditures of 'brick and mortar', but it also includes systems and policies which define the infrastructure of a business (Clark, 1996). Therefore, a manufacturing firm's strategy will guide the decisions on each of the priorities in which the firm chooses to compete. In addition, some (Hayes and Wheelwright, 1984; Skinner, 1996) have argued that attaining sustainable competitive advantage cannot be achieved without including infrastructural considerations in such decisions as equipment selection choices.

Skinner has proposed the use of manufacturing strategy to gain sustainable competitive advantage since 1969 (Skinner, 1969). Others continue to study this problem (e.g. Leong et al., 1990; Mills et al., 1995). The industrial community looks for methods of gaining competitive advantage through manufacturing techniques like just-in-time or quality improvement programs (De Meyer et al., 1989). Skinner (1996) has recently warned against the pitfalls of using these techniques (referred to collectively as advanced manufacturing techniques or AMTs) without using an operations and/or business strategy as a guiding vehicle. Skinner points out that using competitive priorities does not necessarily mean a strategic framework is used. Some researchers (Ferdows and De Meyer, 1990) have offered ideas about how to use AMTs in strategic initiatives. Without a strategic framework, any competitive advantage that may be obtained ultimately can be lost.

Skinner (1996) recommends a framework of strategic design considerations. He lists six areas of strategic design: (1) vertical integration, (2) level of capacity, (3) equipment and process choice, (4) facility numbers, location, and sizes, (5) infrastructure decisions, and (6) management techniques. These six areas overlap Hayes and Wheelwright's (Hayes and Wheelwright, 1984) eight decision areas of manufacturing strategy. Hayes and Wheelwright's list is as follows: capacity, facility, technology, vertical integration, workforce, quality, production planning, and organization. Skinner (1996) lists 35 AMTs, so as a matter of perspective, if a company chooses to compete on any one or two, like JIT, TQM, or re-engineering, then that company is limiting itself within Skinner's strategic framework. Of the six strategic design categories, Skinner (1996) states that capacity levels and equipment/process choices are probably two of the most understudied areas in this field. Tracey et al. (1999) argue that investing in advanced manufacturing technology and facilitating manufacturing managers in strategy formulation improve competitive capability.

The strategic priorities on which manufacturing firms choose to compete are referred to as competitive priorities (Schmenner, 1984; Fine and Hax, 1985; Hayes, 1985; Skinner, 1985). Competitive priorities in manufacturing can include cost, innovation, quality, delivery performance (dependability and speed), flexibility, and rapid new product introduction (Vickery, 1991; Ward et al., 1998). These compet-