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A comparative analysis of utilizing activity-based costing and the theory of constraints for making product-mix decisions

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Abstract

Activity-based costing (ABC) and the theory of constraints (TOC) represent alternative paradigms for evaluating the economic consequences of production-related decisions. However, their application can lead to contradictory product-mix decisions. To resolve this conflict, it is frequently suggested that the TOC is appropriate for the short run, while ABC is appropriate for the longer term. This paper models the selection of a product mix with the TOC and an ABC model integrating activity-based cost with the capacity of production-related activities. The paper demonstrates that management's discretionary power over labor and overhead resources determines when the TOC and ABC lead to optimal product-mix decision. Equally important, it demonstrates that both the TOC and ABC may lead to a suboptimal product mix across a wide range of economic conditions. The paper develops a more general model of the product-mix decision and demonstrates that the TOC and ABC are special cases of this model. Finally, the paper discusses how the general model may be used to supplement information provided by the TOC and ABC.

Keywords: Activity-based cost; Theory of constraints; Product-mix decision

1. Introduction

Activity-based costing (ABC) and the theory of constraints (TOC) represent alternative paradigms to traditional cost-based accounting systems. Both paradigms are designed to overcome limitations of traditional cost-based systems and, thereby, provide more relevant information for evaluating the economic consequences of resource-allocation decisions. While their objectives are similar, the means used to achieve these objectives differ significantly. ABC models the causal relationship between products and the resources used in their production. This enables ABC to provide more accurate product-cost information for evaluating the profitability of the firm's product lines and customer base [1]. Conversely, the TOC represents an application of general systems theory for optimizing production. It uses the most constrained of the firm's activities to guide production and process improvement decisions. Firms adopting the TOC

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indicate that it has aided in reducing lead time, cycle time, and inventory, while improving productivity and quality [2].

One of the questions confronting many managers today is deciding which paradigm to select for production-related decisions. Studies comparing the decision usefulness of ABC and the TOC are contradictory. Low [3] and Spoede et al. [4], using numerical examples, illustrate that the TOC leads to a more profitable product mix than ABC. Low ([3], p. 36) noted that the "activity-based cost allocation procedure was a great deal more complex than traditional costing procedures, but it was not particularly helpful in a strategic sense". Kee [5], using a similar example, illustrates that an ABC model integrating the cost and capacity of production activities outperforms the TOC. The generalizability of these studies is limited due to their use of numerical examples to illustrate the relationship between the TOC and ABC. Consequently, more rigorous analysis is needed to assess the generalizability of the Low [3], Spoede et al. [4], and Kee [5] studies and to reconcile their contradictory conclusions.

The complementary nature of the TOC and ABC has been examined by Bakke and Hellberg [6], MacArthur [7], and Holmen [8]. They suggest that the TOC is appropriate for the short run, while ABC is appropriate for longer-term decisions. However, as noted by Bakke and Hellberg ([6], p. 13), there is no clear-cut demarcation between short-term and long-term decisions and short-term decisions may have longer-term economic consequences. Time is a surrogate in these studies for other factors in the firm's operations that determine when the TOC and ABC lead to optimal resource-allocation decisions. However, the nature and impact of these factors on ABC and the TOC were not addressed. Accordingly, determination of these factors is crucial for understanding the strengths and limitations of the TOC and ABC as information systems.

This study examines the economic conditions under which the TOC and an ABC model incorporating the cost and capacity of production activities lead to an optimal product-mix decision. It demonstrates that the TOC and ABC lead to an optimal product mix under specific sets of economic conditions. Equally important, it also illustrates that both models may lead to a suboptimal product mix across a wide range of economic activity and suggests an alternative model that may be used to supplement information provided by the TOC and ABC individually.

2. Activity-based cost and the theory of constraints

ABC is an economic model of an organization's production-related activities ([9], p. 58). The causal relationship between products and customers that consume resources is determined by tracing cost based on the factor (cost driver) that causes or correlates highly with a product's or customer's use of an activity's resources. ABC traces cost to products based on volume-related factors, such as unit-, batch-, and product-level cost drivers as well as non-volume-related cost drivers, such as product diversity, complexity, and quality. Surveys and interviews with managers using ABC indicate it is used to support a wide range of economic activities, such as product mix, pricing, and outsourcing decisions [1]. However, evidence of enhanced financial performance resulting from firms adopting ABC is somewhat limited ([1], p. 54).

Noreen [10] examined the conditions necessary for ABC to provide relevant data for dropping a product from the firm's product mix and for designing a product. For these decisions, a firm's costs must be separable into cost pools, each of which is dependent upon a single cost driver. Secondly, it requires that the cost in each pool must be proportional to the level of activity in the cost pool. Consequently, the cost function used to model each pool must be linear with a zero intercept. Finally, it requires that the activities of each cost pool must be separable with respect to the products they are used to produce. This precludes any form of dependencies between products in the production process. The conditions specified by Noreen [10] were developed for specific decision contexts. However, these conditions affect the ability of ABC to accurately trace the cost of resources to products. Consequently, the conditions necessary for ABC to provide highly accurate product cost may be quite stringent.

ABC has been criticized for its usefulness in supporting short-term decisions [11]. ABC traces the