

A constraint-based framework for strategic cost management

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Keywords

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Constraint handling

Abstract

Since the 1980s, firms have searched for better ways to align their cost management systems with the realities of their business environments. The advent of accelerated global competitiveness, reduced product life cycles, rapid technological advancements, and inter-organizational supply chains have drastically increased the need for more effective approaches to cost management. In recent years, activity-based, constraint-based, and hybrid cost management systems have been adopted by some firms to dampen the effects of their traditional (full-absorption) costing methodologies. However, a holistic approach is needed to facilitate strategic cost management based upon organizational objectives, organizational needs and capabilities, and customer requirements. The Theory of Constraints provides the foundation for developing cost management systems that are global, integrative, and strategic in nature. A framework is presented in this paper for using a constraint-based approach to strategic cost management.

1. Introduction

Management accounting systems evolved during the late nineteenth and early twentieth centuries to support the growing industrial activities in Europe and the USA. Most of the features seen in today's traditional cost and managerial accounting were established by the 1930s. While the business environment has undergone dramatic changes since the 1970s, very little change has occurred in the fundamental principles used in the supporting accounting systems.

Most firms have separate financial and management accounting systems. Financial accounting systems are designed to translate company activities into dollar values that are reported to various external entities. The methods and procedures must conform to Generally Accepted Accounting Principles (GAAP). This system acts on the behalf of shareholders and other concerned parties (i.e., the government and other stakeholders) to reflect the current and future realities of the business in financial terms. Through the analysis of financial reports, stakeholders are provided "information" for making short- and long-term investment decisions, judgments concerning acquisitions or joint ventures, etc. In theory, cost and managerial accounting systems are designed to furnish "information" for internal decision making. These systems should provide the firm with revenue and cost information that reflects the current and future realities of the business in relation to goals, customers, finances, and resources.

Since the 1980s, there has been a considerable amount of research on the problems associated with using traditional (full absorption) accounting systems in firms transitioning toward world-class

operating principles and techniques. Kaplan (1983) was among the first to identify the shortcomings of traditional accounting in today's manufacturing environment. Others such as Miller *et al.* (1986), Goldratt and Fox (1986), Howell and Soucy (1987a, b, c), Johnson and Kaplan (1987), Foster and Horngren (1987), Plossl (1987), Finch and Cox (1989), Fry and Cox (1989), Morgan (1989), Burns and Kaplan (1990), Vollmann (1991), Fry (1992), Bhimani (1994), and Plenert (1999) have continued to reveal the shortcomings of traditional accounting practices and how true operational and division performance is misrepresented and distorted. In addition, the increased need for accounting information to support just-in-time systems (Boyd *et al.*, 2002), lean manufacturing (Toomey, 1994), new product development activities (Anderson and Sedatole, 1998; Boer and Ettl, 1999; and Hertenstein and Platt, 2000), procurement strategies (Ellram, 2000), and costs shared between organizations (Cooper and Yoshikawa, 1994) place additional burdens on traditional accounting systems which further expose their limitations and shortcomings.

1.1 Purpose

The purpose of this paper is to provide a conceptual framework for constraint-based strategic cost management that incorporates organizational objectives, internal needs and capabilities, and customer requirements. The framework is based on an empirical study conducted by Lockamy and Cox (1994) of six world-class manufacturing firms. Contained in this paper is: an examination of approaches used to manage cost; a discussion on the concept of strategic cost management; a conceptual framework for constraint-based strategic



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cost management; and conclusions regarding the use of constraint-based strategic cost management approaches for achieving competitive advantages.

2. Approaches to cost management

In this section, three of the most prevalent approaches to cost management are examined: traditional (full absorption) accounting, activity-based accounting, and constraint-based accounting systems. A discussion on the use of hybrid approaches to cost management is also provided in this section.

2.1 Traditional (full absorption) accounting

As stated earlier, for many firms the traditional accounting system has been a major impediment to progress toward becoming a world-class organization. While firms engage in activities to promote increased competitiveness, traditional accounting systems monitor progress based on outdated measures. For example, capital investment decisions based solely on discounted cash flows, net present values, payback periods and internal rates of return discourage long-term strategic investments that improve resource- and customer-oriented performance areas. The current competitive environment requires that capital investment decisions be made within the context of the company's strategy. Also, the investments must be viewed holistically. Traditional accounting systems view each capital request as a stand-alone project having no relationship to either current or future ventures.

High labor efficiency and machine utilization measures are hallmarks of traditional accounting systems. These measures drive manufacturing organizations toward local optimas by encouraging the unnecessary use of local resources. World class firms attempt to synchronize organization resources to achieve a "global optima." Labor and machines should be used only when required for the achievement of the company's goals, objectives, and strategy, not to improve labor efficiencies and machine utilization figures. In addition, departments are penalized for negative variances on labor and machine hour variance reports. To make matters worse, in order for production personnel to achieve high labor and machine utilization figures, excess inventory is required at each work station. The inventory allows for long production runs with few changeovers,

leading to increased labor efficiency and machine utilization.

It is easy to see how labor efficiency and machine utilization measures lead to managerial decisions, actions and behaviors destructive to achieving world-class capabilities. In order for accounting systems to add true value to the organization, the competitive reality faced by most firms demands that the systems are supportive of the new operating environment.

2.2 Activity-based accounting

Activity-based accounting is defined as the collection of financial and operational performance information about significant activities of the business (Brimson and Berliner, 1988). This methodology incorporates the idea that costs are incurred through a firm's activities. Therefore, the accounting system is designed to capture and track performance for only those few significant activities that constitute the bulk of the total work within a given organization. Under activity-based accounting, cost allocations to products are based on those activities that drive cost (Helberg *et al.*, 1994). Initially, activity-based accounting was primarily used to establish a product's sales price based on relevant activity costs and the desired profit margin. Today, this approach is also used to evaluate advanced manufacturing systems (Park and Kim, 1995), drive operational improvements (Cooper and Slagmulder, 1999a), serve as a decision support system (Van damme and Van der zon, 1999), facilitate capital budgeting (Cook *et al.*, 2000), and measure customer value (Ness *et al.*, 2001).

Activity-based accounting is designed to attribute activity costs more precisely to cost objects (parts, products, product lines, functions, departments, plants, divisions, etc.). In contrast to traditional accounting that usually uses direct labor as the only cost driver for overhead allocation, activity-based costing may use several cost drivers to allocate overhead. Activity-based accounting has a number of proponents (Kaplan, 1990; Cooper and Kaplan, 1991; Kaplan, 1992). However, some accounting researchers are warning companies of its shortcoming relating to its reliance on cost pools and cost drivers (Johnson, 1992; Darlington *et al.*, 1992). The selection of cost pools and cost drivers is critical to the performance of an activity-based accounting system. Failure to recognize the types of actions managers will take based on cost allocations can create problems within an organization. For example, suppose all

costs related to design changes (product/process changes, drafting, etc.) were collected in a cost pool and allocated based on the number of engineering changes. What would be your action as a product line manager if you knew your products were going to be allocated engineering overhead costs based on the number of engineering changes? You would probably delay the engineering changes and batch several together on one engineering change form. What is the impact on the resource, the customer, and the finance functions? Workers and engineers would probably be upset and confused by a set of drawings and instructions that incorporated several changes at one time. The customers might go to a competitor for the product since you seem unresponsive to their needs. The product line manager might be charged less overhead in the short run, but what is the impact in the long run on revenues caused by not responding to engineering changes to a product? Certainly, you as a manager might want to rethink the allocation driver so that it promotes responsiveness to customers' needs. Some researchers are still debating the virtues and shortcomings of activity-based accounting (Johnson, 1992; Kaplan, 1992).

2.3 Constraint-based accounting

In using constraint-based accounting, fixed costs are not allocated to products. While traditional cost accounting systems focus on product costs, the constraint-based accounting system focuses on the firm's profitability through the measures of Throughput (T), Inventory (I) and Operating Expenses (OE). *Throughput* is defined as the rate at which the system generates money through sales. The actual money generated by the system is equal to sales minus the purchased materials (i.e. true variable cost per unit) used in the specific items sold. *Inventory* is defined as all the money the system invests in purchasing things the system intends to sell. This definition disregards value added as part of the inventory valuation (inventory is valued at raw material cost only). Equipment and facility investment are also considered inventory. *Operating Expenses* is defined as all the money the system spends in turning inventory into throughput. Direct labor and all other general expenses are considered fixed and as such, operating expenses. Using these definitions, net profit is computed by subtracting total operating expenses from the total throughput. Return on investment is determined by dividing net profit by

inventory. In this scheme, increasing Throughput, and/or decreasing Operating Expenses achieve profitability gains.

Goldratt (1990) states that an increase in Throughput is the primary avenue for profit improvement, since Throughput is inherently unlimited. Inventory is next in level of importance, due to reductions in inventory translating into improvements in the strategic objectives (i.e. improved quality, delivery, lead time, reduced cost, etc.), therefore impacting Future Throughput. Operating Expenses (i.e. cost) is ranked third in importance. Constraint-based accounting uses constraint pricing to establish product prices. In constraint pricing, a minimum price for products is established based on constraint capacity. If the constraint is internal to the operation, minimum product prices are established which allow for Throughput increases (i.e. market segmentation). If excess capacity exists, minimum product prices are set based upon variable costs. The key is to segment the market so that prices in one market have no impact on prices in other markets. Constraint-based accounting is similar to a direct costing methodology, with one major difference. Although neither method uses an overhead allocation scheme for determining product costs, constraint-based accounting considers direct labor to be fixed in the short run and is therefore an Operating Expense. In contrast, the direct costing approach treats labor as a variable cost and it is specifically assigned to a product. This is significantly different from both traditional full absorption and activity-based accounting methods which use overhead allocation schemes to determine product cost.

Constraint-based accounting is a simple costing system that allows a firm to evaluate the impact of local decisions on the goal of the organization. Constraint-based accounting is supported by basic economic theory related to fixed, variable and marginal costing concepts.

Constraint-based accounting represents a major departure from the value-added concept, and the traditional view of labor being treated as a variable cost. Constraint-based accounting requires a significant change in the role and actions of traditional managers, in the policies and procedures of the organization, and in the measurement system. Although the benefits of constraint-based accounting are well documented (Macarthur, 1996), some activity-based accounting proponents are still questioning its applicability and effectiveness (Holmen, 1995).

2.4 Hybrid approaches to cost management

In an attempt to combine the benefits offered by activity-based and constraint-based cost management approaches over the traditional approach, some researchers and firms have merged these methodologies to create hybrid cost management systems. Kee (1995) developed a model illustrating how the Theory of Constraints (TOC) may be integrated with activity-based costing. The resulting model captures the interaction between the cost, physical resources, and capacity of production activities. The model enables an optimal production mix to be determined from simultaneous evaluation of ABC data and physical attributes of the production process. Also, it facilitates identifying a bottleneck activity that constrains the firm's production opportunities and may lead to excess resources in the firm's other production activities. Sensitivity analysis may be used to estimate the benefits that might accrue from relieving a constraint and identifying the subsequent set of activities that will become a bottleneck as prior constraints are relieved. Baxendale and Gupta (1998) analyzed the integration of activity-based cost management and TOC by a custom screen-printing business. Fritzsich (1998) examined activity-based costing and TOC with respect to their implicit assumptions concerning time horizons. The author concluded that TOC emerged as a short-run decision tool while activity-based costing had its primary application in strategic planning and control. To reconcile this dilemma, Fritzsich offers an integrated approach incorporating elements of both methods. Finally, Cooper and Slagmulder (1999b) argue that while the profitability maps created by an activity-based costing system are powerful strategic tools, they are based on general-purpose costs designed to focus managerial attention, not to directly support decisions. To make an informed decision, a company must convert the activity-based costing resource usage analysis into information pertaining to resource supply. The authors contend that the conversion from resource usage to resource supply information is particularly important when the proposed change in resource usage predicted by the activity-based costing system is not mirrored by an equivalent change in resource supply. When management accepts that a capacity limit exists, they must be sensitive to bottlenecks. To accommodate bottlenecks, the authors conclude that the best solution is to use the Theory of Constraints to identify the optimal short-term mix of products that can be manufactured.

3. Strategic cost management

Due to accelerated global competitiveness, reduced product life cycles, rapid technological advancements, and inter-organizational supply chains, cost management has become a critical survival skill for many firms. Strategic cost management is the application of cost management techniques to simultaneously improve the strategic position of a firm and reduce costs (Cooper and Slagmulder, 1998a). In addition, Grundy (1996) states that strategic cost management offers a more coherent process for managing costs for both financial and competitive advantage. According to Grundy, it has contributed significantly to more effective management of shareholder value, organizational change, and to minimizing the adverse effects of organizational politics.

Since the objective of strategic cost management is to reduce costs while simultaneously strengthening the strategic position of the firm, it cannot, like traditional management accounting, limit itself to either the four walls of the factory or the boundaries of the firm (Cooper and Slagmulder, 1998b). Thus, cost must be analyzed with respect to both internal and external resources and customers, along with products. A holistic and integrative approach to cost management gives a firm the ability to examine its cost patterns based upon organizational objectives, organizational needs and capabilities, and customer requirements.

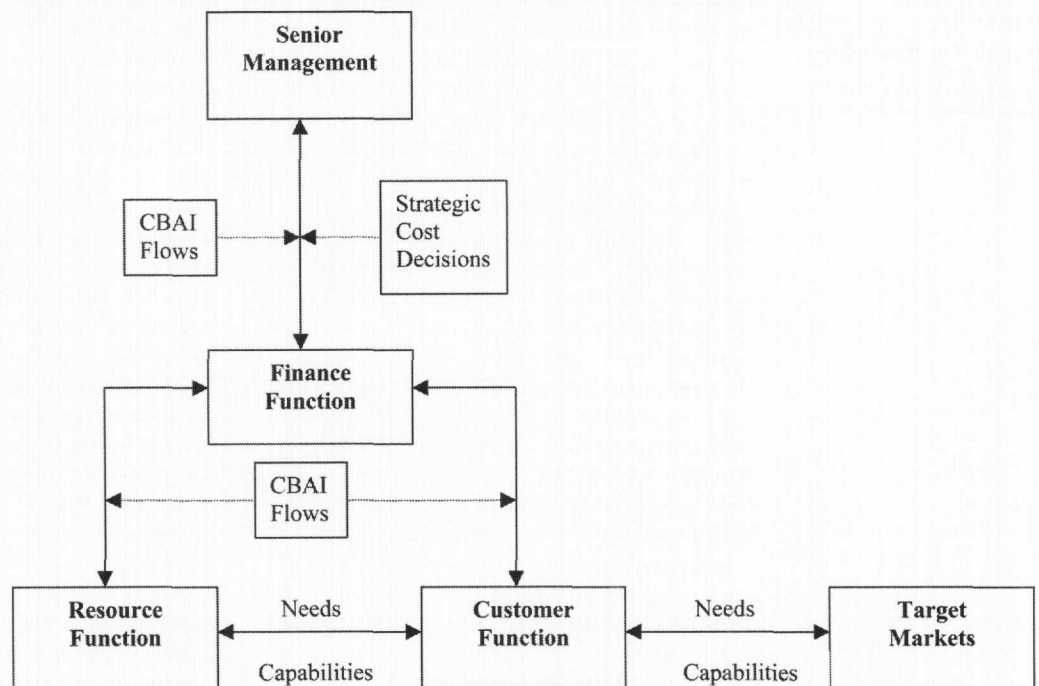
There are two key requirements for achieving the objective of strategic cost management: first, a systematic approach for analyzing costs in relation to organizational objectives, needs and capabilities within the context of customer requirements; and second, a cost management approach that facilitates a holistic, integrative examination of cost relative to an organization's fundamental goals and objectives. TOC provides the foundation for developing cost management systems that are global, integrative, and strategic in nature. A framework for using a constraint-based approach to strategic cost management is presented in the following section.

4. Conceptual framework

A conceptual framework for constraint-based strategic cost management is presented in Figure 1. The framework is a variation of the generalized organizational performance

Figure 1

Conceptual framework for constraint-based strategic cost management



measurement system model presented by Lockamy and Cox (1994).

In order for firms to sustain and improve upon their competitive positions, it is necessary to assess the current and future needs of their targeted markets. This is achieved through the customer function. The customer function is comprised of the firm's marketing, sales and field service organizations. Marketing is responsible for determining the proper product mix for a given market segment, establishing pricing strategies, promoting the product mix for awareness, and identifying the strategic location of product outlets within a given market area. Sales personnel provide the firm with a direct link to customers. The sales staff helps customers define specific product or service requirements, solve customers' problems, collect field information on competitors, and serve as the firm's primary representative to customers. Field service organizations provide customers with repair, replacement, and troubleshooting assistance. These activities not only provide an opportunity to develop increased customer loyalty but also provide a unique opportunity to collect vital information for product and service improvement. The customer function plays a key role in strengthening the strategic position of the firm through identifying potential opportunities for increasing revenue by changing the current product and

service offering to match the customers' needs and expectations.

The resource function includes research and development, design engineering, procurement, key suppliers (external resource), production, warehousing, and distribution. This function is responsible for regulating the effective use of organizational resources engaged in the development, creation, and delivery of goods and services to targeted markets. The resource function must assess its ability to accommodate customers' needs and expectations based on market information provided by the customer function. In addition, the resource function must make decisions regarding resource control in the short run to ensure the effective scheduling, monitoring, and controlling of organizational resources. Similar decisions must also be made for the medium and long terms for effective resource planning. Managers must assess the use of organizational resources to support the strategic objectives that contribute to the overall goals of the firm.

The finance function is comprised of the firm's accounting and financial organizations. This function uses accounting data to track financial performance in terms of revenue, cost, profit, assets, and liabilities. The finance function provides senior management a linkage to the customer and resource functions through the dissemination of relevant accounting information to support their strategic

decision-making processes in these areas. Investment decisions based on return-on-investment, net present value, internal rates of return, and payback period are driven primarily by information provided by the finance function. Operating expenses for direct labor, indirect labor, and salaries of staff specialist and line managers in addition to expenses for utilities, raw materials, indirect and support materials, transportation, sales commissions, advertising, sales, and other needs are analyzed and distributed throughout the firm by the finance function.

In order for the framework provided in Figure 1 to achieve the objectives of strategic cost management, a cost management approach must be used that allows for a holistic, integrative examination of cost relative to an organization's fundamental goals and objectives. Constraint-based accounting provides the necessary methodology for systematic and dependable strategic cost management within a firm.

4.1 Constraint-based strategic cost management example

An example of using the constraint-based strategic cost management framework in Figure 1 is provided next. Suppose that a firm has the following cost structure in relation to its normal retail prices of 50 percent materials, 15 percent direct labor, 25 percent overhead (15 percent fixed and 10 percent variable) and a 10 percent profit margin. The firm is currently working at only 70 percent capacity, and has a strategic objective of no layoffs due to its highly skilled work force. Senior management recognizes that it is currently experiencing a business slowdown as a function of the business cycle. This business slowdown has lasted for the past two years, and senior management sees no upturn on the horizon. The customer function has identified a new foreign customer who is interested in placing a one-time order for \$700,000 worth of business. However, the normal retail value for such an order is \$1,000,000. Thus, the customer is requesting a 30 percent discount from the retail price. The customer function relays the customer information to the resource function to determine if it is capable of accommodating the order. Upon assessing its current capabilities, the resource function determines that it has the capacity to make the order without disrupting current production. Additionally, the customer function relays the customer and constraint-based accounting information (CBAI) to the finance function to assess the economic impact on the firm of accepting the order.

CBAI relating to variable cost increases in the resource function associated with the potential order is also provided to the finance function. The finance function analyzes the merits of the order using constraint-based accounting. The finance function recognizes that the variable cost of producing the order is 50 percent direct materials and 10 percent variable overhead. By analyzing the situation using constraint-based accounting, the finance function discovers that 70 percent of the retail price [$(\$700,000/\$1,000,000) \times 100$ percent] is greater than the 60 percent variable cost (50 percent + 10 percent). Upon further analysis, the finance function reveals that the firm is receiving Throughput of \$100,000 ($\$700,000 - \$600,000$) and no increase in operating expense. Thus, the contribution to fixed costs and profit for the organization is \$100,000. The CBAI analysis is forwarded to senior management. The managers quickly recognize that although the order is for 70 percent of the retail price, it is 10 percentage points above the product cost. Since the firm will receive a \$100,000 benefit, senior management approves the acceptance of the order. Using a strategic cost management approach based on CBAI analysis, senior management was able to ensure that the firm's cost structure and resource deployment was not adversely affected by a market opportunity revealed by the customer function, while simultaneously improving Throughput and satisfying a strategic objective.

5. Managerial Implications

The constraint-based strategic cost management framework illustrated in Figure 1 can provide managers with a mechanism for facilitating organizational changes between the customer, resource, and finance functions that result in more effective strategic cost management. Additionally, the framework can be used to positively impact managerial behavior within these primary business functions.

5.1 Implications for organizational change

In using a constraint-based approach to strategic cost management, functional managers can no longer operate independent of each other in their attempt to optimize local costs without regard to other functional areas. To respond to the customers' expectations, managers in the customer function must provide senior managers with the CBAI needed to assess the financial impact of falling short, meeting, or exceeding these expectations. This information must

also be shared with managers in the resource function to determine the impact on resource utilization, along with the associated costs. Financial managers must also examine the CBAI to analyze how managerial activities relating to customers' needs in the customer function and resource deployment in the resource are affecting organizational performance. Thus, a constraint-based approach to strategic cost management will require managers to adopt a more holistic view of the organization, as well as an integrative management style with respect to other functional areas of the business. The framework illustrated in Figure 1 provides the means by which organizations can achieve this change.

5.2 Implications for managerial behavior

Goldratt (1990) offers the following quote with respect to managerial behavior and performance measurement: "Tell me how you measure me and I'll tell you how I will perform. If you measure me in an illogical way . . . do not complain about illogical behavior." The constraint-based strategic cost management framework provided in Figure 1 can be used to facilitate "logical" managerial behavior that supports overall organizational goals. To illustrate how this behavior contrasts with typical managerial behavior in the primary business functions, the following examples are provided below.

5.2.1 Implications for managerial behavior: customer function example

To minimize the cost of after-sales service, you, as the field service manager, constantly monitor warranty and repair costs. To effectively manage this cost center, policies and procedures are developed to do as little warranty repair work as possible. However, this results in high levels of customer dissatisfaction along with a loss of future business. You now decide to manage field service as a separate profit center. Repair work is now encouraged because the desired result is to now make high profits. However, in order to achieve high profits, the customer is charged an excessive amount for each repair job. The actual results are high customer dissatisfaction along with little return business for repairs or for buying replacement product. As a separate profit center, you end up with the same result as in the cost center scenario: less profit for the organization. Senior management would not have supported either behavior by the field service manager upon examining the CBAI provided via the constraint-based strategic cost management framework.

5.2.2 Implications for managerial behavior: resource function example

As the product engineering manager for a company, you decide that minimizing product cost is the key to strategic success. To monitor progress towards this objective, target costs are developed for each product. This strategy leads to engineering designs that attempt to minimize the cost of purchasing or manufacturing each component of a given product. However, the result is a low-cost product with frequent field failures, high warranty costs, customer dissatisfaction, and eventual loss of market share. Thus, the product engineering manager's localized cost measurement system supported behaviors that created a loss of revenue (customer function) and additional expenses in other areas (resource function). The constraint-based strategic cost management framework would have provided a more global assessment of the proposed action via CBAI, and senior management would not have supported the aforementioned behavior by the product engineering manager.

5.2.3 Implications for managerial behavior: finance function example

Finally, your organization is in an industry that has been under intense pressure from tough global competition for a number of years. Its profitability has been on the decline, and it is currently losing money. The organization decides to focus its processes on maximizing quarterly profits. As the financial manager, you insist on quarterly profit and loss statements from each operating division. What will be the behavior of division managers to increase short-term profits under these conditions? Long-term capital investments will be either delayed or altogether avoided by these managers. Thus, long-term profitability is severely damaged, market share erodes, and the future survival of the business is questionable. Using the constraint-based strategic cost management framework, senior management would have been alerted of the potential impact of these practices and would have taken the appropriate action to discourage these behaviors.

6. Conclusions

Industrial competition in the twenty-first century requires firms to manage cost in a manner that results in improved customer satisfaction, resource utilization, profitability, and strategic position. The traditional (full-absorption) approach to cost management has failed to provide firms with

a method for consistently achieving the above requirements in the current business environment. Although activity-based and hybrid approaches to cost management provide improvements over the traditional approach, a systematic means for achieving strategic cost management is needed for firms to simultaneously assess its customers, resources, and finances within the context of its goals, objectives and strategy. Constraint-based accounting provides the basis for facilitating strategic cost management within firms. Through the analysis of Throughput (T), Inventory (I), and Operating Expenses (OE), constraint-based accounting focuses the firm on maximizing profitability (as opposed to minimizing cost) by increasing T, decreasing OE, or both. Thus, constraint-based accounting is designed to achieve the two objectives of strategic cost management: reduce costs while simultaneously strengthening the strategic position of the firm. The framework provided in Figure 1 that utilizes constraint-based accounting for strategic cost management can be adopted by practicing managers to assist them in ensuring the long-term viability and competitiveness of their enterprises.

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