INTEGRATING ABC AND THE THEORY OF CONSTRAINTS TO EVALUATE OUTSOURCING DECISIONS

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Outsourcing — the purchase of components and services from external suppliers — has traditionally been a short-term response to reducing cost and/or relieving production constraints. However, in recent years, it has become a means for restructuring a firm's operations. Outsourcing involves examining the activities used in producing a firm's products to determine which should be performed internally and which should be purchased from suppliers.

Activities that enable the firm to differentiate its products and provide it with a cost advantage enhance the firm's competitive position and financial performance. These activities would be poor candidates for outsourcing. Conversely, those activities that are essentially a commodity frequently contribute little to the firm's competitive or financial position. These activities are good candidates for outsourcing because commodity components may be purchased from more cost-efficient suppliers, enabling the firm to share in their efficiency. More importantly, it enables the firm to focus its capital and human resources on activities that are critical to its success.

Few firms can perform all of the activities needed to produce its products efficiently. Outsourcing involves identifying and focusing the firm's resources on those activities that are critical to its success and leaving its remaining activities to more cost-efficient suppliers.

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EXECUTIVE SUMMARY

- *Outsourcing is a process for restructuring a firm's operations to create a more flexible, focused, and competitive production structure. Outsourcing involves differentiating between commodity components and those that are strategic to the firm's products.*
- *Information developed from the theory of constraints (TOC) and activity-based costing (ABC) may be integrated to evaluate the economic consequences of outsourcing commodity and strategic components.*
- *The TOC and ABC may be used to evaluate the economic feasibility of outsourcing, the time frame over which it is feasible, and the reason(s) why it is economically feasible.*

Outsourcing Problems and Solutions

The objective of outsourcing is to enhance the firm's performance. However, firms that have outsourced their components and products have frequently experienced increased rather than decreased costs.[1] This often results from using inaccurate estimates of a product's cost. Howell and Soucy cite a firm that implemented an activity-based costing (ABC) system and discovered that it had previously outsourced products that were profitable to produce, while it continued to manufacture those that were unprofitable.[2]

Outsourcing has also led firms to lose critical skills that impaired their future profitability.[3] Knowledge and skills gained through manufacturing products can deteriorate through outsourcing and reduce the firm's ability to develop

and manufacture future products. Finally, firms that have outsourced their components and products have had suppliers leverage the knowledge and skills gained through outsourcing to become their competitors.[4]

Outsourcing decisions are based, in part, upon the economics of producing the firm's products. Accurate estimates of a product's cost are, then, crucial for making outsourcing decisions that enhance the firm's competitive advantage and financial performance. Inaccurate estimates of a product's cost can lead to outsourcing products that would be more economical to produce and manufacturing those that would be more cost efficient to purchase.

The purpose of this article is to discuss how information developed from the theory of constraints (TOC) and ABC may be integrated to assess the economic consequences of outsourcing. The article demonstrates that (1) the TOC and ABC reflect different aspects of a firm's operations; and (2) information developed from both models may be used to provide deeper insights into an outsourcing decision. The production activity examined in the article is outsourcing components comprising a firm's products. This is a common type of outsource decision and one that is critical for manufacturing businesses.

This article begins by discussing the different types of outsourcing. This is followed by a brief discussion of the TOC and ABC and their strengths and limitations for supporting resource-allocation decisions. The section after that presents a numerical example to illustrate the application of the TOC and ABC for evaluating outsourcing.

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STRATEGIC AND COMMODITY COMPONENTS

A significant activity for many manufacturing companies is producing the components comprising its products. A product's components can be classified as either strategic or commodity components. Strategic components embody the company's core competencies, such as its proprietary knowledge of product design and manufacturing skills. These competencies are reflected in components that enable the company to differentiate its products and/or provide the company with a cost advantage relative to its competitors. Strategic components and their underlying core competencies are those a company must control and nurture to maintain and enhance its competitive position. For example, Honda Motor Company's strategic components are its engines and power train. While Honda outsources many of the components comprising its products, it produces its own engines and power train because the ability to design and build these items provides a competitive advantage for its products.[5]

Alternatively, some companies outsource strategic components, but in a way that they can retain control over their core competencies. For example, outsourcing through joint development or partial ownership of a supplier may be used to protect and maintain the company's critical skills and knowledge.[6]

Commodity components are those that do not differentiate the company's products from those of competitors. These components result from mature technologies with little or no potential for learning. Outsourcing commodity components does not result in the risk of losing key skills or learning opportunities. Conversely, producing these components involves the commitment of capital and human resources frequently with minimal return.

Commodity components have traditionally been produced to provide companies with control over their products and provide economies of scale and scope. However, today's global competition has eroded many of these advantages. Companies that specialize in manufacturing commodity components can often produce them more efficiently than companies producing them for their internal production needs.

TIME HORIZON

Outsourcing decisions also have short- and long-term economic consequences. In the short run, a company may produce a component even though it may be purchased at a lower price than the company's long-term production cost. In the short run, the contractual and managerial policies governing labor and overhead expenditures make them difficult to control or influence. Consequently, much of the company's labor and overhead costs may be incurred whether a component is produced or purchased from a supplier. The incremental cost, then, of producing a component in the short run may be less than a supplier's price as well as the company's long-term cost. Under these conditions, the company

EXHIBIT 1
Outsourcing Cases

Case	Component Type	Relationship of Supplier's Price to Company's Production Cost	Outsourcing Implications
One	Commodity	Supplier's price < short-run production cost Supplier's price < long-run production cost	Outsource short-run Outsource long-run
Two	Commodity	Supplier's price ≥ short-run production cost Supplier's price < long-run production cost	Produce short-run Outsource long-run
Three	Commodity	Supplier's price < short-run production cost Supplier's price ≥ long-run production cost	Outsource short-run Produce long-run
Four	Commodity	Supplier's price ≥ short-run production cost Supplier's price ≥ long-run production cost	Produce short-run Produce long-run
Five	Strategic	Supplier's price < long-run production cost	Evaluate further
Six	Strategic	Supplier's price ≥ long-run production cost	Produce

would find it advantageous to produce rather than purchase the component.

Conversely, a company may choose to outsource a component in the short run, even though its purchase price is higher than the company's long-term cost. When the company's production capacity is fully utilized, producing a component forces the company to forego other production opportunities. In effect, producing the component has an *opportunity cost*. Therefore, in the short run, a component's incremental and opportunity cost may exceed the supplier's purchase price. Under these conditions, the company may find it more profitable to purchase rather than produce the component. In the short run, the relevant costs for evaluating whether a component should be outsourced are the incremental and opportunity costs expected from its production.

In the long run, a company's management can adjust its manufacturing capacity to meet the market demand for its products. Therefore, the opportunity cost of using limited production capacity is no longer a factor affecting an outsource decision. Equally important, in the long run, a company's management can adjust its contractual and managerial policies governing labor and overhead resources to meet its production needs. In effect, over an extended time horizon, a company's management has discretionary power over the resources used in a component's production. Therefore, the relevant cost for evaluating outsourcing in the long run is the cost of the resources used in a component's production.

If the cost of producing a component is greater than its purchase price, it suggests that the company's production processes are relatively inefficient. Equally important, it indicates that the company is at a competitive disadvantage with respect to its competitors. If the company produces the component, its competitors have the option of purchasing the component at a lower cost from suppliers. This would place the company's products in which the component is used at a cost disadvantage.

For commodity components, the relationship between a supplier's price and a component's short- and long-run production costs creates four cases, or categories, of outsourcing. The four cases, the relationship of a supplier's price relative to a component's short- and long-run production costs, and the implications for outsourcing are shown in Exhibit 1. As indicated, each case involves assessing whether a commodity component should be outsourced in the short run and the long run:

- In *Case One*, the purchase price of a supplier is less than the company's short- and long-run production costs. Therefore, the company is confronted with the need to outsource the component in the short run as well as in the long run.
- In *Case Two*, the supplier's price is greater than or equal to the company's short-term cost but less than its long-term cost. Under these conditions, the component should be produced in the short run but outsourced at some point in the future.
- *Case Three* is similar to Case One, except that the supplier's price is greater than or equal to the company's long-run production cost. Therefore, the company is confronted with the need to outsource the component in the short run but produce it at a later date for the long term.

If I leave production I save:
① Variable costs
② Opportunity cost (I have op. costs if I decide to produce the item → investment)

■ *Case Four*, the final case, involves a supplier's price being greater than or equal to the company's short- and long-run costs. Under these circumstances, the company should produce the component in the short run as well as over the long run.

Strategic components are those in which the company has a long-term commitment. Consequently, short-term economic considerations are less important when evaluating strategic components than when evaluating commodity components. Equally important, non-financial considerations play a more prominent role in determining whether to outsource a strategic component. However, the long-term cost of producing strategic components is important for understanding the economic consequences of their production.

Outsourcing strategic components involves two cases. These two categories, the relationship of a supplier's price relative to a component's long-term costs, and the implications for outsourcing, are described in Cases Five and Six in Exhibit 1.

As indicated in *Case Five*, a supplier's price is less than the company's long-term cost. Consequently, the component must be evaluated further to identify strategies for reducing its cost. If its cost cannot be reduced sufficiently to justify production, then outsourcing may be considered.

In *Case Six*, the supplier's price is greater than or equal to the company's long-term cost. Therefore, the component should continue to be produced.

Each of the outsourcing cases listed in Exhibit 1 will be discussed in conjunction with an example used to illustrate outsourcing later in the article. However, first, the role of a cost information system for measuring the economics of production activities and their limitations will be discussed.

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ABC AND THE TOC

The role of an accounting information system is to provide information for planning and controlling the company's operations to achieve its financial objectives. To accomplish this, an accounting information system must measure the economic consequences of resource-allocation decisions. However, traditional cost-based accounting systems can significantly distort a component's or product's cost. Consequently, it can lead to suboptimal production decisions. ABC and the TOC were developed to overcome these deficiencies.

ABC

ABC traces indirect cost-to-cost objects, such as components, products, and customers, based on factors (cost drivers) that cause or correlate highly with indirect costs. It also traces indirect costs on the basis of the structural level at which costs are incurred in the production process. For example, many indirect costs are incurred at the batch, product, and facility levels.[7] The use of multiple cost drivers and tracing cost at the structural level at which they are incurred enables ABC to model the relationship between the resources consumed by production activities and the products they are used to produce. ABC thereby provides a more accurate estimate of the cost of the resources used to produce a product, as well as the cost of the individual activities used in its production.

ABC has been criticized for its inability to support short-term decisions.[8] Under ABC, the cost of the resources used in production is traced to products.[9] However, many of the company's resources are contracted in advance of usage (e.g., rent on factory equipment) or influenced by management policy (e.g., retaining workers in periods of excess labor capacity). In the short run, a company is unable to adjust its expenditures for these types of resources to meet its production needs.

Therefore, the cost of the resources traced to a product under ABC may not reflect the incremental cost of their production in the short run. In other words, some of the labor and overhead cost traced to a product in the short run under ABC may be a committed cost the company will incur whether the product is produced or not. Consequently, the cost behavior reported by ABC for making production-related decisions in the short run may not reflect the level of spending the company will incur from these decisions.[10]

ABC has also been criticized for its failure to incorporate constraints into the analysis of a company's products.[11] In the short run, the capacity of production-related activities is limited. However, ABC fails to incorporate the opportunity cost of using the most constrained activity, or bottleneck, that restricts production.

TOC

The TOC differs from a traditional cost-based accounting system in several important respects. First, the TOC incorporates a bottleneck activity that restricts the company's

EXHIBIT 2
XYZ Inc.: Operating and Cost Structure

Panel I: Activity-Based Cost, Price, and Demand

	Components				Product	Production Capacity
	C1	C2	C3	C4	P1	
① Fabrication labor hours	2.00	1.50	0.50	2.00	2.00	660,000
② Assembly labor hours	2.00	0.25	0.50	1.50	2.00	423,000
Direct material cost	20.00	15.00	15.00	60.00	100.00	
Direct labor cost	48.00	21.00	12.00	42.00	48.00	
Overhead cost*	144.00	63.00	36.00	126.00	144.00	
Unit-level cost	212.00	99.00	63.00	228.00	292.00	
Batch-level cost						
Set-up	0.80	0.25	0.10	1.60	1.60	
Purchasing	0.90	0.18	0.09	1.35	1.35	
Product-level cost						
Engineering	2.00	1.00	0.50	4.00	2.00	
ABC cost	$215.70	$100.43	$ 63.69	$234.95	$296.95	
Price	**	**	**	**	$460.00	
Profit	**	**	**	**	$163.05	
Expected demand	100,000	100,000	100,000	100,000	150,000	

*300% of direct labor cost
**Not applicable

DRIVER = LABOR HOURS (TRADITIONAL COST ACCOUNTING)

Panel II: Batch-Level Activities

	C1	C2	C3	C4	P1	
Set-up						
Batch size	500	200	200	500	500	
Hours/batch	2	0.25	0.1	4	4	
Expected cost						$430,000
③ Expected capacity						2,150
Cost per set-up hour						$ 200
Purchasing						
Batch size	1,000	2,000	2,000	1,000	1,000	
Orders/batch	10	4	2	15	15	
Expected cost						$351,000
④ Expected capacity						3,900
Cost per purchase order						$ 90

Panel III: Product-Level Activities

	C1	C2	C3	C4	P1	
Engineering						
Drawings/component	200	100	50	400	300	
Expected cost						$1,200,000
⑤ Expected capacity						1,200
Cost per engineering drawing						$ 1,000

performance into production-related decisions. Goldratt indicates that any system must have at least one constraint that restricts the company's ability to achieve its goal.[12]

Secondly, the TOC is implemented through three measurements: (1) *throughput*, the rate at which the system generates money through sales; (2) *inventory*, all money the system invests in purchasing items the system intends to sell; and (3) *operating expenses*, all money the system spends in turning inventory into throughput.[13] Operationally, throughput is defined as a product's price less the cost of direct material used in its production. Labor and overhead used in a product's production are treated as committed costs (i.e., the company will incur the costs of these resources, regardless of how they are used in production).[14] Therefore, the cost of labor and overhead used in a component's or product's production is not relevant to resource-allocation decisions. The objective of the TOC is to maximize throughput, subject to the capacity of the individual production activities of the company.

The TOC has been criticized for its inability to support long-term economic decisions.[15] In the long run, a company's management can influence labor and overhead resources. Therefore, labor and overhead are discretionary costs with

discrecional = no sometidos a reglas.

respect to producing a component or product. However, the TOC excludes these costs from production-related decisions and may lead to producing products whose revenue will be less than the cost of the resources used in their production. This may lead to suboptimal production-related decisions. Advocates of the TOC focus on optimizing the company's short-term performance. However, a series of successive, optimal, short-term decisions may be suboptimal relative to a decision made initially that incorporated a long-run economic perspective of the company's operations.

Complementary Strengths

ABC and the TOC reflect different assumptions about the relevance of labor, overhead, and production capacity for allocating economic resources. The validity of these assumptions is dependent, in part, upon the time horizon chosen for making these decisions.

Over a sufficiently short time horizon, labor and overhead are committed costs, and the opportunity cost of using a bottleneck activity is relevant for evaluating the allocation of economic resources. Under these circumstances, the TOC measures the incremental and opportunity costs of production.

Conversely, over a sufficiently long time horizon, labor and overhead are discretionary costs, and production capacity can be adjusted to meet the company's production needs. Therefore, ABC reflects the cost the company may expect to incur from production-related decisions.

In effect, ABC and the TOC reflect the economic consequences of resource-allocation decisions over different time horizons because the strengths of ABC and the TOC are complementary in nature. The strengths of each may be used to overcome limitations of the other.

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AN INTEGRATION EXAMPLE

To illustrate the integration of information that may be developed from the TOC and ABC for evaluating the economic consequences of outsourcing, consider the example provided in Exhibit 2. XYZ, Inc. is a medium sized company that has traditionally produced the components comprising its products. However, due to eroding profit margins and market share, XYZ, Inc. has decided to evaluate outsourcing as a means of restructuring its production activities to restore its competitive position.

XYZ management has decided to focus initially on one of its component facilities. The plant currently produces components C1, C2, C3, and C4, which are used in a variety of XYZ's products. If any of the components are outsourced, product P1 will be produced with the released capacity. An analysis of the components revealed that they are produced from mature technologies with minimal potential for product differentiation and learning. In effect, each component is a commodity type component.

Operating and cost data for the component facility are listed in Exhibit 2. Direct material and labor costs are traced to individual components. Unit-level overhead was estimated using direct labor hours as the cost driver. Set-up and purchasing costs are incurred at the batch level, while engineering cost is incurred at the product level. These costs, their cost driver, and batch- and product-level cost rates are given in Panels II and III, respectively.

Based on how products use batch- and product-level resources, their costs were converted to an equivalent unit cost. For example, the set-up activity in Panel II is expected to provide 2,150 hours of set-up time while incurring a cost of $430,000. The cost-driver rate for the set-up activity is $200 per set-up hour. Component C1 is produced in batches of 500 units requiring two set-up hours per batch. Therefore, the cost of a set-up for producing a C1 is $.80 per unit. Similarly, Component C1 requires 200 engineering drawings (see Panel III) at a cost of $1,000 per drawing. The expected demand for Component C1 is 100,000 units. Therefore, the cost of engineering for Component C1 is $2.00 per unit.

The costs of the resources used to produce Component C1 were added to derive its ABC cost of $215.70 in Panel I. XYZ has traditionally used its components internally; therefore, the sales price and profit for each component are not applicable to the analysis. Conversely, Product P1, which will be produced from the capacity released from outsourcing, can be sold for $460, while incurring a cost of $296.95, resulting in a profit of $163.05 per unit.

The short-run cost of a component is determined, in part, by the opportunity cost of the bottleneck activity used in its production. Goldratt proposes identifying a bottleneck by examining the relationship between the resources

EXHIBIT 3
XYZ Inc.: Bottleneck Identification

Resources Available	Quantity	① Fabrication 660,000 (Labor Hours)	② Assembly 423,000 (Labor Hours)	③ Set-up 2,150 (Hours)	④ Purchasing 3,900 (Orders)	⑤ Engineering 1,200 (Drawings)
Production Requirements:						
Component C1	100,000	200,000	200,000	400	1,000	200
Component C2	100,000	150,000	25,000	125	200	100
Component C3	100,000	50,000	50,000	50	100	50
Component C4	100,000	200,000	150,000	800	1,500	400
Total Requirements		600,000	425,000	1,375	2,800	750
Excess Capacity		60,000	-2,000	775	1,100	450
Bottleneck		No	Yes	No	No	No

required for production and those available at production-related activities over some scheduling horizon.[16] If the resources required for production from an activity exceeds the resources available, then the company has at least one bottleneck.

To identify XYZ's bottleneck activity, Exhibit 3 compares the resources available in each activity with those required to produce the company's components over a one-year period. In Exhibit 3, the resources available for production are listed below each activity and the resources used to produce each component are listed below the row labeled "Production Requirements."

For example, the resources required to produce Component C1 are listed in the row labeled "Component C1." The resources used to produce C1 were computed by taking the number of units of C1 to be produced in the "Quantity" column and multiplying it by the resources required to produce a unit of C1 listed in Exhibit 2. The resources required for each component were added to get the "Total Requirements." The resources in "Total Requirements" were then subtracted from "Resources Available" to get each activity's unused resources or "Excess Capacity." As indicated, each activity, except assembly, has excess capacity. Therefore, the assembly activity is the most constrained or the plant's bottleneck activity.

The short-run cost of producing XYZ's components is given in Panel I of Exhibit 4. Under the TOC, a component's cost consists of the opportunity cost of using a bottleneck activity and its direct material cost. Labor and overhead are assumed to be committed costs and, therefore, irrelevant for production-related decisions. However, even in the short run, a company's management may have some control over labor and overhead resources. In these circumstances, the labor and overhead that management has control over need to be added to the TOC to compute a component's short-run production cost.

The opportunity cost of producing a component is the benefit of the best alternative that was given up for its production. The production capacity released from outsourcing a component will be used to produce product P1. Therefore, the opportunity cost of producing a component is the throughput of product P1 the company foregoes by a component's production. The throughput for product P1 is its sales price of $460 less direct material cost of $100, or $360. The production of product P1 requires two hours in assembly (see Exhibit 2). Hence, the opportunity cost of using the assembly activity is $180 per assembly hour.

The opportunity cost for producing each component was computed by taking the time required for its production in the bottleneck and multiplying by the opportunity cost of using this resource. For example, the opportunity cost of producing Component C1 was computed by taking the two hours required for its production in assembly times the $180 opportunity cost per hour in assembly. The cost of direct material used to produce C1, $20, was added to its opportunity cost of $360 to gets its cost under the TOC of $380. An analysis of the labor and overhead resources used to produce Component C1 revealed that $30 of these resources could be deployed elsewhere in the company or could be terminated if the component was not produced. When discretionary labor and overhead are added to the cost under the TOC, Component C1's short-run cost is $410.

The short-run cost of the other components in Exhibit 4 were computed in a similar manner.

EXHIBIT 4

XYZ Inc.: Short-Run, Long-Run, and Purchase Costs

	Components				Product
	C1	C2	C3	C4	P1
Panel I: Short-run Cost					
Opportunity Cost	$360.00	$ 45.00	$ 90.00	$270.00	$360.00
Direct Material Cost*	$ 20.00	$ 15.00	$ 15.00	$ 60.00	$100.00
TOC Cost	$380.00	$ 60.00	$105.00	$330.00	$460.00
Labor and Overhead**	$ 30.00	$ 10.00	$ 15.00	$ 25.00	$ 0.00
Total	$410.00	$ 70.00	$120.00	$355.00	$460.00
Panel II: Long-run Cost					
ABC Cost*	$215.70	$100.43	$ 63.69	$234.95	$296.95
Panel III: Purchase Price	$200.00	$ 90.00	$ 80.00	$400.00	$460.00

*Taken from Exhibit 2
**Discretionary Labor and Overhead

Panel II in Exhibit 4 lists each component's long-run cost computed under ABC (see Exhibit 2 for details of how these costs were determined). The last panel in Exhibit 4 lists the lowest bid received for each component from vendors who meet XYZ's reliability and quality standards.

Analysis of Commodity Components

An examination of the relationship between the purchase price and short- and long-run production costs of the components in Exhibit 4 and those in Exhibit 1 indicate that each component reflects one of the four cases of outsourcing a commodity component.

Case One. The first commodity component or C1's purchase price of $200 is less than its short- and long-term production cost of $410 and $215.70, respectively. A review of Exhibit 1 indicates that Component C1's purchase price and costs present an example of Case One. Accordingly, as suggested in Exhibit 1, Component C1 should be outsourced over the short as well as the long term.

The need to outsource a component in the short run frequently arises from the opportunity cost of using a bottleneck resource. As indicated in Exhibit 4, Component C1's opportunity cost causes its short-run cost to exceed the outside vendor's price. Therefore, Component C1 is uneconomical to produce in the short run because the bottleneck resources used in its production can be used more profitably to produce other products.

Conversely, the need to outsource a component in the long run reflects the efficiency of the company's production processes relative to those of a supplier. As indicated in Exhibit 4, the cost of the resources used by the company to produce Component C1 is greater than the supplier's price. Assuming the supplier is not selling the component at a loss, XYZ is not as efficient as the supplier in producing the component. Consequently, Component C1 is uneconomical for the company to produce over any time horizon, and the company should consider outsourcing Component C1 immediately and should negotiate a long-term contract to meet its future production needs.

Case Two. In Exhibit 4, the second commodity component or C2's purchase price is greater than the company's short-term cost but less than its long-term cost. An examination of Exhibit 1 indicates this is consistent with Case Two.

As indicated in Exhibit 1, the company should produce Component C2 in the short run but outsource it at a later date. For Case Two to occur, a component's long-term cost must be greater than its short-term cost. The difference between a component's short- and long-run costs reflects the difference between its opportunity cost and the cost of non-discretionary labor and overhead used in its production. The opportunity cost of using a bottleneck resource and the cost of non-discretionary labor and overhead resources used in production are both short-term costs.

However, a component's opportunity cost is reflected in its short-run cost, while the cost of labor and overhead that are non-discretionary in the short run are reflected in its long-run cost. Consequently, for a component's long-term cost to exceed its short-term cost, the cost of non-discretionary labor and overhead must exceed the component's opportunity cost of using a bottleneck resource.

EXHIBIT 5
XYZ Inc.: Bottleneck Verification

Resources Available	Quantity	Fabrication 660,000 (Labor Hours)	Assembly 423,000 (Labor Hours)	Set-up 2,150 (Hours)	Purchasing 3,900 (Orders)	Engineering 1,200 (Drawings)
Production Requirements:						
Component C2	100,000	150,000	25,000	125	200	100
Component C4	100,000	200,000	150,000	800	1,500	400
Total Requirements		350,000	175,000	925	1,700	500
Capacity Released		310,000	248,000	1,225	2,200	700
Production Requirements:						
Product P1	124,000	248,000	248,000	992	1,860	300
Excess Capacity		62,000	0	233	340	400
Bottleneck Activity	No	Yes	No	No	No	

The labor and overhead resources that are non-discretionary in the short run but are included in Component C2's long-run cost come to $75.43. This was computed by subtracting C2's direct material and short-run discretionary labor and overhead costs of $15 and $10, respectively (as shown in Panel I of Exhibit 4), from its long-run cost of $100.43 (as shown in Panel II). The difference between Component C2's short- and long-run cost, which is $30.43, is equal to the difference between its non-discretionary labor and overhead cost in the short run of $75.43 and its opportunity cost of $45.

The non-discretionary labor and overhead cost excluded from Component C2's short-run cost causes its short-run cost to be less than the supplier's price, even though its long-term production cost is higher than the supplier's price. Consequently, the need to produce Component C2 in the short run is the result of using non-discretionary labor and overhead resources in its production. However, as the company's management is able to gain discretionary power over these resources, the resources become a cost of producing Component C2, causing the production of Component C2 to become uneconomical over the long term.

An important aspect of implementing outsourcing in Case Two is to determine the time frame over which the component should be produced. Failure to identify the point at which the company should stop producing and begin purchasing Component C2 is critical for preventing a series of successive short-term decisions leading to producing the component over an extended time period.

The time horizon for producing a component in Case Two is determined by how quickly the company's management can gain control over non-discretionary labor and overhead resources, making them equal to the difference between a component's short-term cost and purchase price. For Component C2, this difference is $20. Therefore, the company must determine the time frame required to redeploy or terminate $20 or more of the non-discretionary labor and overhead used to produce Component C2. This is the length of time the company should plan to produce Component C2 and the point at which the company should begin purchasing the component from a supplier.

Case Three. The third commodity component or C3's purchase price is less than its short-run cost, but greater than its long-term cost. An examination of Exhibit 1 indicates this relationship is consistent with Case Three. As indicated in Exhibit 1, the company should outsource Component C3 in the short run but produce it at a later date for the long term. For the economic conditions of Case Three to occur, a component's short-term cost must exceed its long-term cost. As noted in Case Two, the difference between a component's short- and long-run cost reflects the difference between its opportunity cost and non-discretionary labor and overhead cost. When a component's short-run cost exceeds its long-term cost, a component's opportunity cost must exceed the cost of non-discretionary labor and overhead resources used in its production.

A review of Component C3 in Exhibit 4 indicates its opportunity cost of $90 does, in fact, exceed its non-discretionary labor and overhead cost of $33.69 (which is arrived at by subtracting from Component C3's activity-based cost of $63.69 the cost of direct material and short-run discre-

tionary labor and overhead of $15 and $15, respectively). The opportunity cost of producing Component C3 causes its short-run production cost to exceed the supplier's price, even though its long-run cost is less than the supplier's price. Therefore, the need to outsource a component in Case Three arises from the component's opportunity cost of using a bottleneck resource. In effect, Component C3 should be outsourced in the short run because the resources used in its production can be used more profitably to produce other products. However, as the company is able to reduce the opportunity cost of producing C3, its cost will fall below the supplier's price and become economical to produce.

Because in Case Three it's uneconomical to produce Component C3 in the short term, but economical to produce it over the long term, the company must determine the time frame over which to purchase C3. Failure to determine the time period to purchase C3 can lead to a series of short-run decisions resulting in purchasing the component long term.

A component's opportunity cost can be reduced by expanding the capacity of the bottleneck activity or reducing the resources required by components using the bottleneck. Either action will reduce a component's opportunity cost and make it more economical to produce. For example, for Component C3, the company should determine the time required to increase the production capacity in assembly or reduce the resources used by components in this activity. The time required to perform either action determines how long Component C3 should be purchased and the

A component's opportunity cost can be reduced by expanding the capacity of the bottleneck activity.

point at which the company should begin producing C3.

Case Four. The fourth component in Exhibit 4 or C4's purchase price is greater than its short- and long-run production costs. As indicated in Exhibit 1, the economic attributes of Component C4 are consistent with Case Four. A review of Exhibit 1 suggests that Component C4 should be produced in the short as well as the long run. Therefore, not only should the company produce Component C4 to meet its production needs, but it should also consider becoming a supplier of C4 to other companies.

Analysis of the cost required to sell Component C4 as well as XYZ's required profit margin may be used to determine whether selling the component is economically feasible. As indicated in Exhibit 4, XYZ has a competitive advantage in producing C4 relative to its other commodity components. Therefore, becoming a supplier of Component C4 is an opportunity to transform the plant from producing commodity components needed to produce the company's products to manufacturing those in which the plant has a competitive advantage.

The Bottleneck Activity. Analysis of XYZ's commodity components in the short run was based on the assembly department as the company's bottleneck activity. Exhibit 5 provides verification that the assembly activity is the bottleneck if components C1 and C3 are outsourced in the short run. The Exhibit is organized in a similar way to that of Exhibit 3, except the resources used to produce components are subtracted from the "Resources Available" to get the capacity released from outsourcing components C1 and C3.

The maximum quantity of product P1 that can be produced with this capacity is 124,000 units. This was computed by dividing the resources needed to produce P1 in Exhibit 2 into the "Capacity Released" in Exhibit 5. The smallest number of units that could be produced was 124,000 for the assembly activity. Therefore, 124,000 units of P1 represent the maximum number of P1 that can be produced. The resources required to produce P1 were subtracted from the "Capacity Released" to give the "Excess Capacity" of each activity. As indicated in the last row of Exhibit 5, outsourcing C1 and C3 and using the capacity released to produce P1 leaves assembly as the most constrained production or bottleneck activity.

The bottleneck for making outsource decisions in the short run is the one that occurs after they are implemented. In effect, determination of both whether a component should be outsourced and the bottleneck activity used to make this decision are made simultaneously. The procedures used in this article identified the bottleneck before components were outsourced. It used the bottleneck to evaluate components for outsourcing and then verified that the bottleneck used initially is the one that will result after outsourcing. Had the bottleneck shifted to another activity from outsourcing, then the procedures

would have to be repeated using the new bottleneck until the constrained activity used to make outsourcing decisions and the one that results from these decisions are the same.

Avoiding Contradictory Decisions. The importance of integrating information from the TOC and ABC to evaluate outsourcing commodity components is illustrated in Cases Two and Three in Exhibit 1. Evaluating the economics of outsourcing with either the TOC or ABC leads to identical decisions in Cases One and Four in Exhibit 1. However, in Cases Two and Three, using either model alone will lead to contradictory decisions. For example, if the TOC were used to evaluate Case Two, the company would produce the component over the short term and make a series of short-term decisions that could lead to producing the component over an extended time period. Conversely, using ABC alone in Case Two could lead to outsourcing the component immediately, even though it is more economical for the company to continue producing the component in the short run.

In instances in which the TOC and ABC lead to the same outsource decision, information developed from the two models provides deeper insights into evaluating the economical feasibility of outsourcing, as well as information on the time horizon over which it's feasible, and the reason(s) why it's economically feasible.

Analysis of Strategic Components

To illustrate the evaluation of strategic components, assume that components C1 and C4 in Exhibit 4 are strategic rather than commodity components. Under this assumption, components C1 and C4 reflect the two cases of outsourcing strategic components listed in Exhibit 1. As indicated in Exhibit 4, Component C1's purchase price of $200 is less than its long-term production cost of $215.70. As indicated in Exhibit 1, Component C1 reflects the economic attributes of Case Five.

The difference between a component's production cost and purchase price should be used to stimulate a program of process improvement.

Under Case Five, the company should evaluate Component C1 further. First, the company should evaluate whether Component C1 enables the company to differentiate its products sufficiently to justify the additional $15.70 of production cost. This requires identifying how the attributes of Component C1 differ from those of the vendor and if these differences add sufficient value to customers to justify the cost differential.

Equally important, the company must identify the core competencies embodied in Component C1 and their importance to the company. For example, if the company's core competencies lie in designing and manufacturing high quality components that enable the company to differentiate its products, then it should continue that production in order to safeguard its future products.

The difference between a component's production cost and purchase price should be used to stimulate a program of process improvement. The difference between a supplier's price and a component's long-term cost less the value it adds to customers through product differentiation measures the cost that must be eliminated to justify the component's production. Analysis of the activities used to produce a component and their costs may be used to identify non-value added activities that may be eliminated. Equally important, it may be used to evaluate alternative design and manufacturing methods for producing the component. The objective of process improvement should focus on improving the efficiency of the production processes used to produce the company's components and products. A program of process improvement that stimulates learning and change can enhance the efficiency of production-related activities that lead to cost reductions without impairing the company's core competencies.

If the difference between a component's purchase price and production cost cannot be reduced sufficiently to justify its production, then outsourcing may be a viable option. However, before outsourcing, the company must first identify the risk involved in purchasing a strategic component. The company must identify the core competencies underlying a component and formulate how to maintain these competencies under outsourcing.

For example, if component design is critical to the products in which it is used, the company may jointly develop components with a supplier. The company would perform component design and maintain engineering personnel at the supplier's plant to facilitate design changes and to maintain the manufacturing skills needed to design the component. To prevent the vendor from leveraging the knowledge gained through outsourcing and becoming a competitor, the company must design a contractual agreement to restrict

the supplier from engaging in activities harmful to the company. If more control is needed, then the company may consider the need to provide a financial incentive to the supplier to restrict its behavior.

When evaluating strategic components, the primary focus is the relationship between a supplier's price and a component's long-run cost. However, insights into the production of strategic components can also be gained through analysis of its short-run cost. An examination of Component C1 in Exhibit 4 indicates that its short-term cost is greater than its long-term cost and the supplier's price. In effect, Component C1 is uneconomical to produce in the short run as well as in the long run.

As indicated in Exhibit 4, Component C1 is uneconomical to produce in the short run due to its opportunity cost. Therefore, if the company decides to continue producing Component C1, then it should either expand the capacity in the bottleneck activity or reduce the resources required by components using the bottleneck. Either action will make Component C1 more economical to produce during the short term.

Component C4's purchase price is greater than its long-term production cost. Assuming that Component C4 is strategic, an examination of Exhibit 1 indicates that it reflects the economic attributes of Case Six. A review of Exhibit 1 suggests that Component C4 should continue to be produced. An analysis of Exhibit 4 indicates that Component C4 provides the company with a cost advantage relative to purchasing the component.

However, the company should again determine the difference between the attributes of Component C4 and that of a supplier and the value added to customers by these differences. That is, what is the value of the ability of Component C4 to differentiate the company's products? Also important, the company should identify the core competencies underlying C4 and how they may be enhanced. Finally, the company should review the activities used to produce Component C4 and their costs. Analysis of these activities and their costs may be used to stimulate organizational learning and change needed to maintain the company's cost advantage.

The objective of outsourcing is to enhance the company's competitive advantage and, thereby, to improve its financial performance.

An analysis of Component C4's short-run cost indicates that it is similar to that of Component C1. Therefore, expansion of the capacity of the bottleneck activity or reduction of the resources used by components in the bottleneck may be used to reduce the opportunity cost of its production.

CONCLUSION

Outsourcing represents a process for restructuring a company's operations to create a more flexible, focused, and competitive production structure. This is accomplished by identifying which activities performed by the company are critical to the company's success and which activities are commodities. Outsourcing involves focusing the company's capital and human resources on activities that enhance the company's competitive advantage and leaving its remaining activities to more cost-efficient suppliers. The objective of outsourcing is to enhance the company's competitive advantage and, thereby, to improve its financial performance. However, companies that have used outsourcing have frequently experienced increases in cost, loss of core competencies, and had suppliers leverage the knowledge gained through outsourcing to become their competitors.

To maximize the benefits of outsourcing while minimizing its potential risk, several principles must be incorporated into an outsource decision:

1. *The Objective of Outsourcing.* Outsourcing to restructure a company's operations to enhance its competitive advantage can have short- as well as long-term benefits to the company. Conversely, outsourcing based on short-term cost reductions and cash flow considerations can lead to unintended and adverse consequences.
2. *Differentiating Components.* A company must differentiate between strategic and commodity components. Outsourcing strategic components involves risking the company's core competencies while commodity components involve little or no risk.
3. *Accurate Cost Data.* The company must use economic data that reflect the short- and long-run costs of a component's production. Failure to use accurate estimates of a component's cost can lead to suboptimal outsourcing decisions.

The TOC and ABC may be used to measure a component's short- and long-run production costs. The information developed from the TOC and ABC may be combined to identify which of the

four cases of outsourcing a commodity component represents. Further, it may be used to determine if outsourcing a commodity component is economically feasible, the time period over which it is feasible, and why it is economically feasible.

For strategic components, a comparison of a supplier's price and its long-run production cost may be used to assess whether further evaluation of the component is needed. If the supplier's price is less than the component's long-term cost minus the value added by the component to customers through product differentiation, then a program of process improvement must be used to reduce its cost. A program of process improvement can stimulate organizational learning and change needed to enhance the efficiency of the company's production processes, without impairing its core competencies.

Finally, if a strategic component's long-term cost cannot be reduced sufficiently to justify its production, then outsourcing may be a viable option. However, the risk involved in outsourcing must be identified and used to structure an outsource agreement that minimizes these risks. While the analysis of short- and long-run production costs illustrated in this article takes time and effort to develop, their costs may be relatively insignificant, compared to the potential benefit of the information it provides for making more informed outsourcing decisions. ■

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