Evaluating Internal Operations and Supply Chain Performance Using EVA and ABC

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Introduction

Firms cannot exist in isolation and must rely on other firms to perform a complex chain of interdependent activities from source-of-supply to the end-user. One company rarely controls an entire supply chain, and success depends on how well the combined capabilities of these firms can be integrated to achieve a competitive marketplace advantage (Cook, DeBree, and Feroleto, 2001). Managers must extend their "line of sight" to understand system-wide performance and the contribution of each firm (Lummus and Vokurka, 1999). They subsequently need to develop measures for on meeting end-user requirements and aligning firm behavior with supply chain objectives. The ability to develop such measures is a major challenge to supply chain management (Pohlen, 2003).

Performance measures are critical to the success of the supply chain (Deloitte, 1999). Companies can no longer focus on optimizing their own operations to the exclusion of their suppliers' and customers' operations (Lummus, Vokurka, and Alber, 1999). By tying manufacturing and supply chain activities to performance outcomes, operations managers and senior executives can make more informed decisions regarding the allocation of scarce resources and the initiatives and partners that are best for the overall supply chain. Managers across an entire supply chain must collaborate to improve performance and obtain the greatest mutual benefit. Performance measures are needed to keep the trading partners aligned with the enterprise-wide goals so supply chain performance can be optimized.

Effective supply chain management requires measures capable of capturing inter-firm performance (van Hoek, 1998) and integrating the results to depict overall supply chain performance (McAdam and McCormack, 2001). Performance must be measured simultaneously across multiple firms, and the measures must demonstrate how each firm's behavior affects the others and the value delivered to the end-user. Supply chain performance measures must translate nonfinancial performance into financial terms and shareholder value (Ellram and Liu, 2002). Supply chain management will affect more than costs, and managers must be able to sell the value created to senior executives, trading partners, and shareholders. Although most managers acknowledge the importance of designing metrics and rewards, they lack an adequate framework for developing suitable performance measures (Kallio, 2000, Simatupang and Sridharan, 2002).

Few firms have measures capable of capturing performance across multiple companies (Keebler, 1999, Lambert and Pohlen, 2001, Lee and Billington, 1992, McAdam and McCormack, 2001, and Simatupang and Sridharan, 2002), and most are not satisfied with the measures they currently use for supply chain performance (Deloitte, 1999). In many instances, the measures identified as supply chain metrics are actually measures of internal operations or logistics performance (Lambert and Pohlen, 2001). Other approaches, such as the total cost of ownership (TCO) or the supply chain operations reference (SCOR) model, measure the effect of suppliers or other trading partners on performance within the firm. They do not measure performance across multiple firms or the overall supply chain.

In an effort to address this shortcoming, we apply a general framework introduced by Lambert and Pohlen (2001) to show how operations performance can be evaluated with a multi-firm, supply chain perspective. The framework can help operations managers achieve supply chain objectives such as "increased shareholder value" and "improved customer service" by providing a concrete roadmap. The focus is on increasing shareholder value for each firm in the supply chain by establishing within-company and cross-company links between actions (i.e., prospective value drivers) and profits. Senior executives can use the framework to determine whether operational-level actions did, indeed, create value, to demonstrate what requires measurement, to focus attention, and to align behavior within each firm with supply chain objectives. The framework differs from other approaches by simultaneously measuring and analyzing inter-firm performance and linking operational performance measures directly to the drivers of shareholder value.

Applying the Framework

The framework employs a dyadic economic value added (EVA) analysis and activity-based costing (ABC). The dyadic EVA analysis 1) evaluates how process changes simultaneously drive value in each firm, and 2) develops measures that align operations performance with supply chain objectives. ABC determines what drives costs and performance (Krumwiede and Roth, 1997, Buckingham and Loomba, 2001) and also translates nonfinancial performance into activity costs and financial measures. EVA and ABC enable managers to optimize and better coordinate the performance of activities across the entire supply chain (Dekker and Van Goor). The framework was adapted for an operational environment by developing five steps, each of which is performed by operations management personnel:

- Establish strategic objectives for the supply chain.
- Map the firms composing the supply chain.
- Examine operational decisions (i.e., potential value creators) using a dyadic EVA analysis.
- Translate process objectives into costs and operational performance measures using ABC.
- Measure and extend analysis to other trading partners.

1. Establish strategic objectives for the supply chain

The corporate strategy of the firm demonstrating the greatest leadership and power provides the most likely starting point for establishing supply chain objectives. Operations managers should look first at strategy when setting objectives and determining what to measure (Neely et al, 2000; Keegan et al, 1989; and Wisner and Fawcett, 1991). The corporate strategy reflects management's choices and trade-offs in its drive to achieve a unique competitive position and maximize shareholder value (Rappaport, 1987). Supply chain strategy flows directly from corporate strategy and the selected target markets by determining the configuration of the processes and companies that best meet end-user requirements and provide the greatest competitive advantage (Lummus, Vokurka, and Alber, 1999). Beginning with the consumer, management works backwards through the supply chain to consider what combination of trading partners best serves the target markets.

During this stage, operations managers perform a competitive analysis of the attractiveness of their industry and their position relative to their competitors. They seek to understand how alternative manufacturing strategies affect the firm's competitive position and the value created. The analysis leads to the selection of strategies that should best achieve corporate objectives and increase shareholder value. The resulting strategic plan and the company's mission statement provide direction and control for subsequent tactical planning and management of daily operations (Stock and Lambert, 2001).

2. Map the firms composing the supply chain

Mapping identifies the companies composing the supply chain from end-users to the raw material suppliers, after step 1 is completed and the most appropriate processes and strategic partners are identified (Stock and Lambert, 2001). Supply chain maps typically appear as a complex web like the branches and roots of an uprooted tree (Lambert and Pohlen, 2001). They rarely resemble the linear pipeline diagrams in most illustrations. This complexity makes it extremely difficult to understand what is actually happening and to communicate objectives across a supply chain (Keebler, 1999, McAdam and McCormack, 2001). Mapping enables managers to better understand their supply chains; however, few firms actually map them (Gardner and Cooper, 2003). Managers use the maps to achieve a competitive advantage — determining which branches or roots generate the most profit, pose the greatest risk, incur unnecessary cost and time, and require focused attention. The maps frequently reveal, previously undetected opportunities. For example, several tier-one suppliers may purchase critical components from the same tier-two supplier. Operations managers can leverage this information and negotiate a single ordering agreement with the tier-two supplier on behalf of their tier-one suppliers. They may also discover opportunities to reduce set-up times, eliminate waste, remove unnecessary intermediaries, and cut cycle times. Analyzing each link in the chain identifies many opportunities for improvement (Lummus, Vokurka, and Alber, 1998), but the value created by these opportunities must be demonstrated and sold to executives in the other firms to secure their buy-in and to align behavior with supply chain objectives.

3. Examine operational decisions (potential value creators) using a dyadic EVA analysis

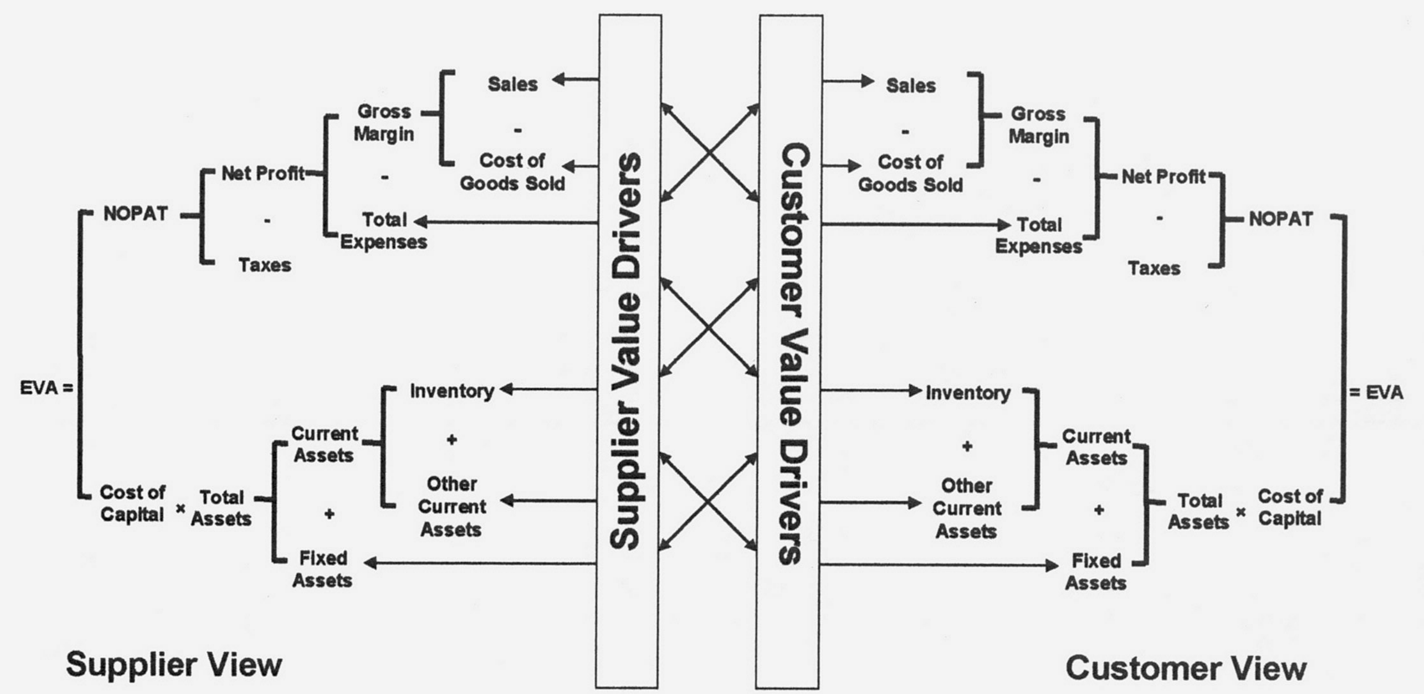
Several processes span each link in the supply chain (Croxton, 2001), and a dyadic EVA analysis shows simultaneously how process changes drive value in multiple firms (Lambert and Pohlen, 2001). EVA has the advantage of providing "...a measure of wealth creation that aligns the goals of divisional or plant managers with the goals of the entire company" (Brewer, 1999). A dyadic EVA takes this a step further by measuring value creation across multiple companies and aligning management decisions with the objectives of the supply chain (Pohlen and Goldsby, 2003). A value-based approach expands the analysis beyond a simple "cost-cost" analysis by examining the effect on revenues, cost-of-goods sold, expenses, and assets. In many instances, a process change will affect activities in multiple companies. A dyadic analysis provides the capability to simultaneously determine the effect of any changes from the supplier's and customer's perspectives (Figure 1).

To illustrate how the value of an operational decision can be assessed within and across firms in the supply chain, consider a manufacturer who is attempting to implement a new manufacturing strategy or production initiative, such as lean production. As part of lean production, the manufacturer must reduce waste or, according to lean production doctrine, nonvalue-added items such as inventory, over-production (producing more units than needed to fill current orders), correction or rework (due to quality defects), the waiting of product during the production process, and overly long processing times. The lean focus also requires the manufacturer to increase its production flexibility.

In partial response to these needs, suppose the manufacturer decides to implement procedures to reduce production setup time. This will reduce setup costs, which are largely a function of production downtime caused by the setup, and thereby reduce production run sizes (i.e., less overproduction). With lower production quantities, average inventory levels will naturally go down as well, since order quantities directly influence the size of cycle stock, thus reducing that element of waste. These smaller production runs will also generate shorter order cycles (or time between orders) for the manufacturer. The shorter cycles, in turn, increase manufacturing flexibility, with a direct benefit for downstream customers. If a particular item is out-of-stock when ordered by a customer, the manufacturer will be able to launch a job to produce the needed item much sooner than if the manufacturer were tied to long production runs. The manufacturer can also afford to implement *heijunka* (Coleman and Vaghefi, 1994) – that is, the ability to make a little bit of everything every day, as opposed to making only one thing for a while before changing over to make something else. As a result, production plans can be set to make workloads much smoother across departments or work centers, and across time periods.

Wastes associated with waiting, processing, and correction also are improved. With shorter setup times and cycles, the likely waiting time for customer orders entering the production process is also reduced, as is the waiting time of work-in-process as it enters production queues. Also, reduced setup times will mean more time available for production, meaning the firm may be able to produce more during a given period, and possibly meet demand it is currently missing. With better designed setups, the scrap generated during and immediately after setups (due to testing) will be reduced. In sum, the potential benefits of a program to reduce setup times are substantial and permeate nearly all of the objectives of a lean production program.

However, note that the preceding concentrates on nonfinancial measures of performance. Ultimately, the performance changes should affect traditional financial measures within the firm. To illustrate, Figure 2 takes the supplier's



Adapted from Stern, Joel M. and John S. Shiely with Irwin Ross, *The EVA Challenge*, New York: John Wiley & Sons, Inc., 2001, Figure 7.2, p. 120 and Pohlen, T. L. and Goldsby, t. J. (2003), "VMI and SMI Programs: How Economic Value Added Can Help Sell the Change," *International Journal of Physical Distribution and Logistics Management*, *33*(7), 565-581.

Figure 1: Using Dyadic EVA Analysis to Demonstrate the Effect of Collaborative Action on Value Drivers in the Supplier and Customer Firms

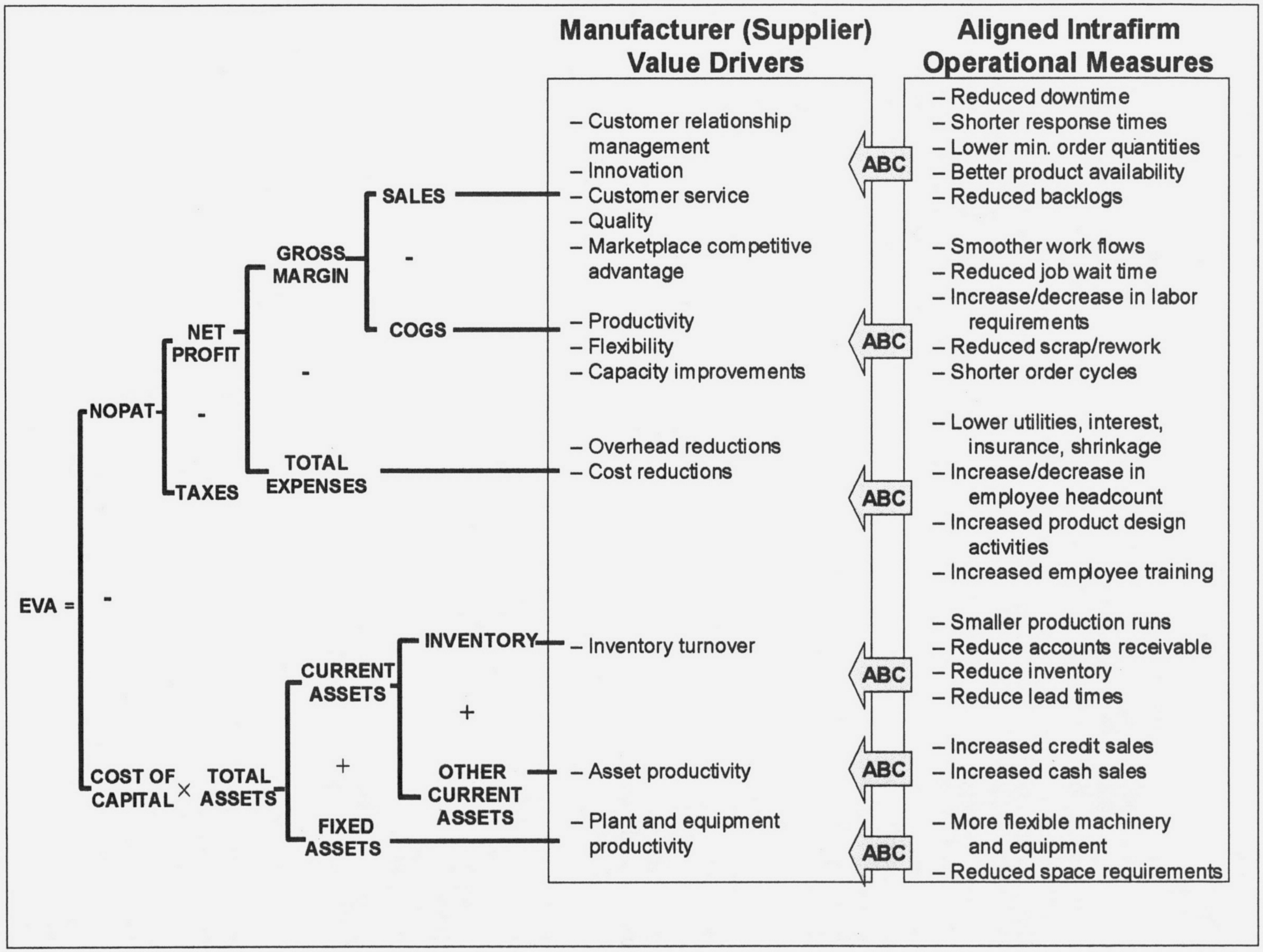


Figure 2: Evaluating the Manufacturer's Value Propositions of Reduced Setup Time

perspective (the left half of Figure 1), and details the value drivers box. Also added is a box listing many aforementioned effects on various operational measures associated with reduced setup time and how they align with the firm's value drivers and financial metrics. As shown, setup time reduction should lead to a commensurate reduction in many of the expenses associated with inventory, including insurance; utilities; personnel directly associated with handling, maintaining, and auditing the inventory; interest (on any borrowing done to finance inventory); write-offs associated with inventory shrinkage due to damage, theft, or obsolescence; and scrap loss formerly experienced during and immediately following inefficient setups, etc. (Courtis, 1995). As a result, cost of goods sold and total expenses should decrease for the manufacturer, leading to a higher gross margin and net profit, respectively, and therefore a higher net operating profit after taxes (NOPAT). These effects are illustrated in the top half of Figure 2.

These benefits typically do not come without a price. In the short term, an investment in personnel time may be required to study setup practices and recommend changes. If a team approach is chosen for major setups, there may be an associated increase in personnel expenses and more employee training may be involved. Improved setups also may require modification of the product design itself to facilitate changeovers, which entails its own set of expenses. These and other costs will to some extent offset the previously noted improvements and will thereby affect the gross margin, net profit, and NOPAT, as shown in Figure 2.

But restricting the analysis to costs wouldn't be appropriate. As Courtis (1995) also notes, the reduction in time and expense, along with the increase in flexibility, should also benefit the revenue side. If cost savings are translated into lower prices for customers, sales volume and total revenue may increase. As noted, an increase in total output by converting setup time to productive time may allow the firm to meet demand it might not otherwise meet, and customer backorders may be reduced or eliminated. The gains in manufacturing flexibility and response time may generate increased business. In addition, the manufacturer may be able to reduce previously imposed minimum order quantities, thereby gaining a wider range of customers. As a result, the firm will see beneficial effects on sales revenue, gross margin, net profit, and NOPAT, over and above those associated with cost improvement (see Figure 2).

Again, however, the analysis shouldn't stop there. Restricting the analysis to revenues versus expenses ignores the impact on a firm's fixed and current assets. Although major investment is not necessarily required to improve setups (Shingo, 1985), this initiative may well require additional investment in fixed assets, such as newer and more flexible equipment (Courtis, 1995) and machinery that can be changed over more easily. Current assets will also be affected; the primary benefit will be the reduction in inventory already documented. However, this will likely be offset somewhat – and, according to Courtis (1995), perhaps completely – by higher cash balances and accounts receivable.

So, how does the firm factor in the classical profit and loss financial information with the changes in total assets? That is the advantage of opting for an EVA approach to see whether the setup reduction initiative generates value for the firm. As illustrated in Figures 1 and 2, the change in total assets is multiplied by the firm's weighted average cost of capital to determine the necessary benchmark return for the assets invested in the venture. If the changes in NOPAT exceed this benchmark, then the initiative creates economic value for the manufacturer.

However, stopping at the firm level would fail to account for the true influence on the manufacturer's supply chain partners and would likely not appropriately capture the total value of the initiative. Consider the corresponding view of one of the manufacturer's key retail customers, and the "mirror image" of Figure 2 that determines the retailer's own value propositions (in Figure 3). Recall that one of the benefits of setup savings is the possible reduction in prices that the retail customer must pay the manufacturer. When translated into the retailer's EVA analysis, the lower prices result in decreased costs of good sold, and a corresponding increase in gross margin, net profit, and NOPAT. Moreover, the manufacturer's faster production capabilities generated through more production uptime and increased flexibility translates into greater on-shelf availability for the retailer and a possible corresponding increase in retail sales and market share. The resulting increase in sales positively affects all profit measures as well.

There are also effects on the retailer's asset base. Suppose that as a result of the setup time savings the manufacturer can ship finished

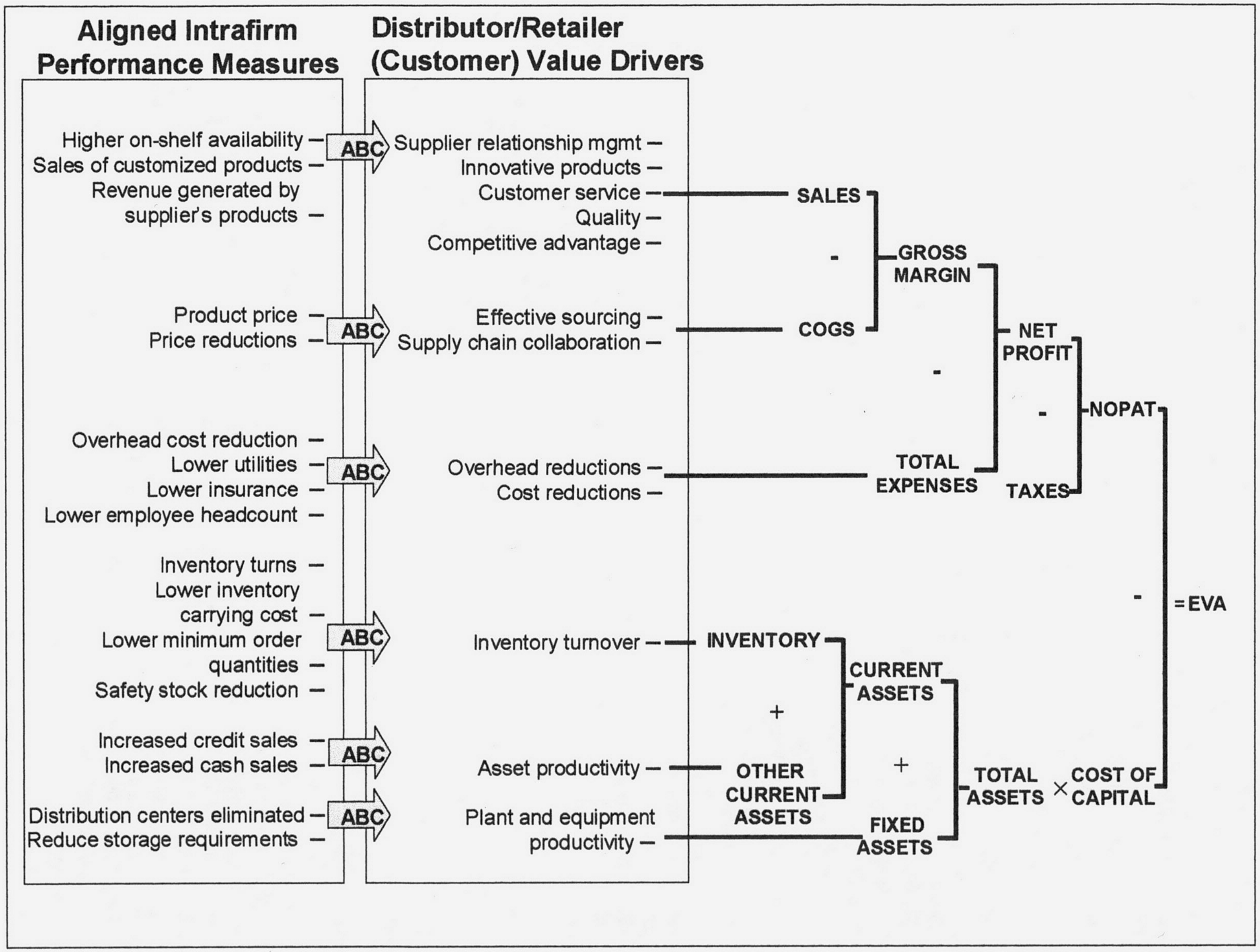


Figure 3: Evaluating the Retailer's Value Propositions of Reduced Setup Time by its Supplier

products more frequently and, in smaller quantities. (Perhaps the manufacturer had been requiring large minimum orders, which can now be greatly reduced). With smaller order quantities, the retailer's own cycle stock is reduced. Furthermore, the retailer's safety stock levels potentially could be reduced, since these are partially a function of lead time from the manufacturer. With better manufacturing response times and reduced backlogs, safety stocks for the retailer can be lowered. The reduction in storage space requirements for the retailer also lowers the percentage of distribution center space allocated to the manufacturer's product. If significant enough, the retailer might even be able to eliminate distribution centers. All of this would have a positive impact on the retailer's total assets. When simultaneously evaluated against the retailer's changes in its own NOPAT, the change in EVA for the retailer can be estimated.

There are tangible benefits for the manufacturer associated with extending the analysis to its trading partner in the manner described. Suppose the manufacturer believes that an increase in selling price is needed to partially justify the investment in setup reduction. This obviously would run counter to the potential price reduction advantages to the retailer mentioned earlier in the section. However, a complete analysis of advantages to the retailer associated with the manufacturers' changes (e.g., in on-shelf availability and improved sales prospects), along with an illustration of the total asset reductions and corresponding increase in EVA for the retailer, could go a long way in selling the price increases to the retailer. It would also avoid the strict cost-versus-cost discussions that classically take place between supply chain partners.

Similar scenarios could also arise in which a member of the supply chain needs inter-firm visibility to make appropriate decisions or to sell trading partners on new initiatives. Suppose the manufacturer, as part of the lean initiative, wants to increase standardization (another lean production concept) by reducing the number or variety of products in its product line. Such a move would make it easier for the manufacturer to deal with the setup issues but would reduce the variety of product offered to the retailer. The retailer will typically view such a move negatively, as it would tend to imply reduced sales volume at the retail level. However, suppose the manufacturer promises a corresponding price decrease, as well as a minimum order reduction. Using the dyadic EVA analysis described, both parties can identify whether the reduction in the product line will pay off.

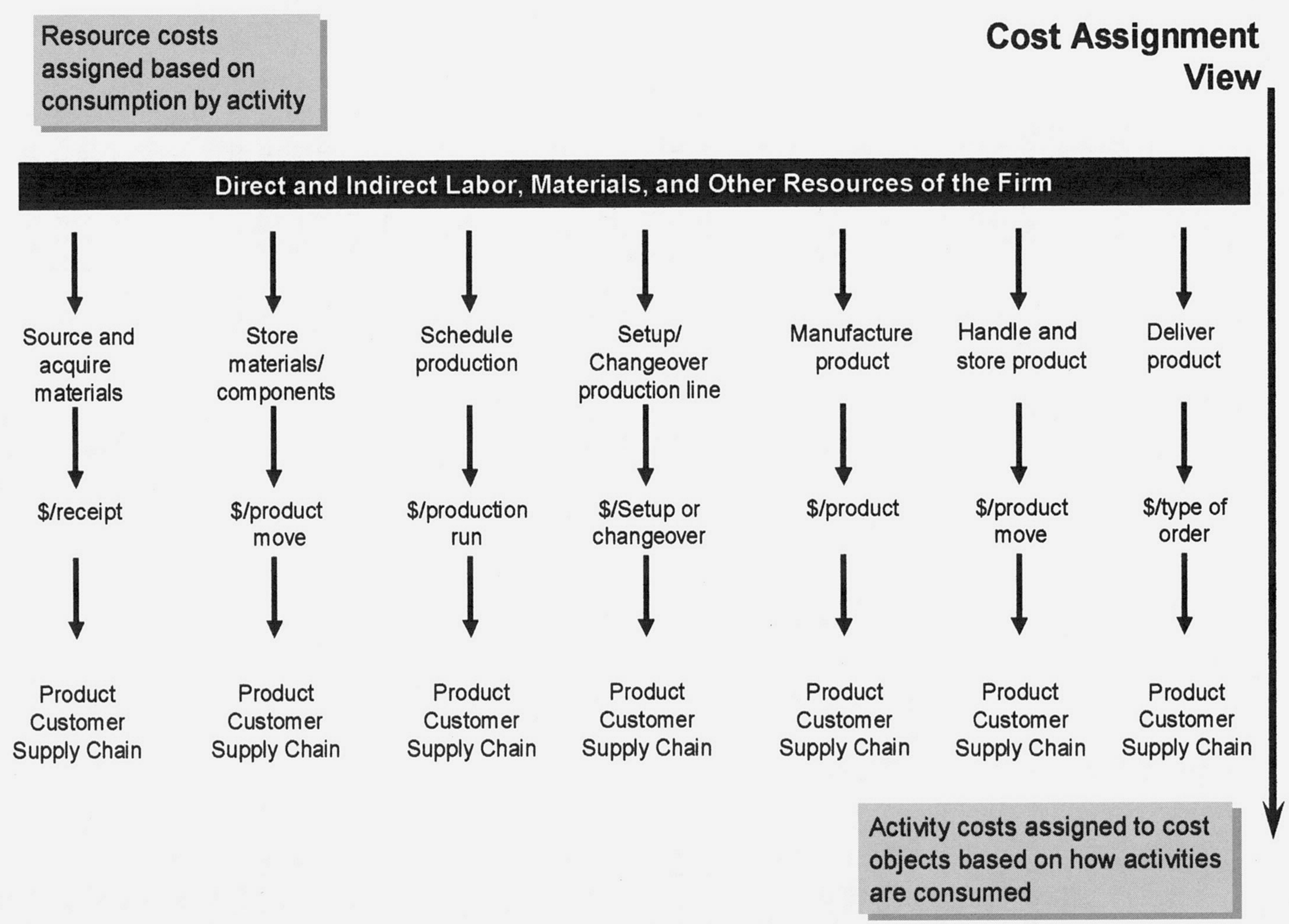
The dyadic EVA analysis demonstrates how working together to achieve supply chain objectives drives value in both firms. A holistic view of the supply chain facilitates communication and enables problems to be identified more easily (Cook, 2001). By incorporating all of the drivers of shareholder value, managers can move beyond cost-cost discussions, where one firm "loses" and another "wins," to identifying inter-firm opportunities that create value for both firms and the entire supply chain.

However, successful inter-firm collaboration will directly depend on the ability to accurately measure and assign any resulting cost changes by product, customer, supplier, or supply chain (Zank and Vokurka, 2003) and on the development of measures that align internal performance with supply chain objectives. This is the role and contribution to the framework performed by activity-based costing.

4. Translate process objectives into costs and operational performance measures using ABC

The financial and performance views of ABC support accurate costing and the development of supporting operational performance measures (Turney, 1991). The cost assignment, or vertical view, of ABC (Figure 4) assigns costs to the activities performed within an organization. An activity-based approach uses multiple drivers to reflect how resources and activities are actually consumed. The use of multiple drivers provides a more accurate assignment of costs than traditional cost systems that typically rely on a limited number of volume-based measures, such as direct labor hours or sales volume (Krumwiede and Roth, 1997). Operations managers can use this view to determine the costs of activities composing their firm's supply chain processes. ABC assigns the costs to the customers, suppliers, products, and supply chains involved in these activities. This cost information can be inserted directly into the dyadic EVA analysis when assessing performance and value resulting from conducting business with a specific customer.

Activity-based management (ABM), or the process view of ABC (Figure 5), decomposes supply chain processes into the specific activities performed within each firm. Operations managers can use this view to develop and align



Adapted from Turney, P. B. B. (1991), *Common Cents*, Hillsboro, OR: Cost Technology and Kaplan, R. S. (2001), "Integrating Shareholder Value with Activity-Based Costing with the Balanced Scorecard," *Balanced Scorecard Report*, *3*(1), 3-6.

Figure 4: Vertical, or Cost Assignment, View of Activity-Based Costing

intrafirm performance measures that support the supply chain objectives. The horizontal perspective increases management understanding of activity performance by breaking down activities into measurable tasks, developing nonfinancial performance measures, and identifying the factors driving activity performance and cost. Management can act on this information to improve activity cost and performance.

An activity-based approach is essential for determining the inputs into the dyadic EVA framework. Reconfiguration of internal operational processes (such as setup time reduction) will drive changes in activities within the firm. ABC captures the effect of these changes in nonfinancial performance, translates the changes into costs, and updates the changes into financial performance and statements. The firm's impact on supply chain partners is also captured through ABC. Changes in performance are translated into assignable cost information that can be applied to the particular partner being studied. Additionally, the determination of assignable nonfinancial performance information helps the firm identify the effect of an activity on factors that cross the supply chain, such as quality, cost, flexibility, dependability, and innovation (Wisner and Fawcett, 1991).

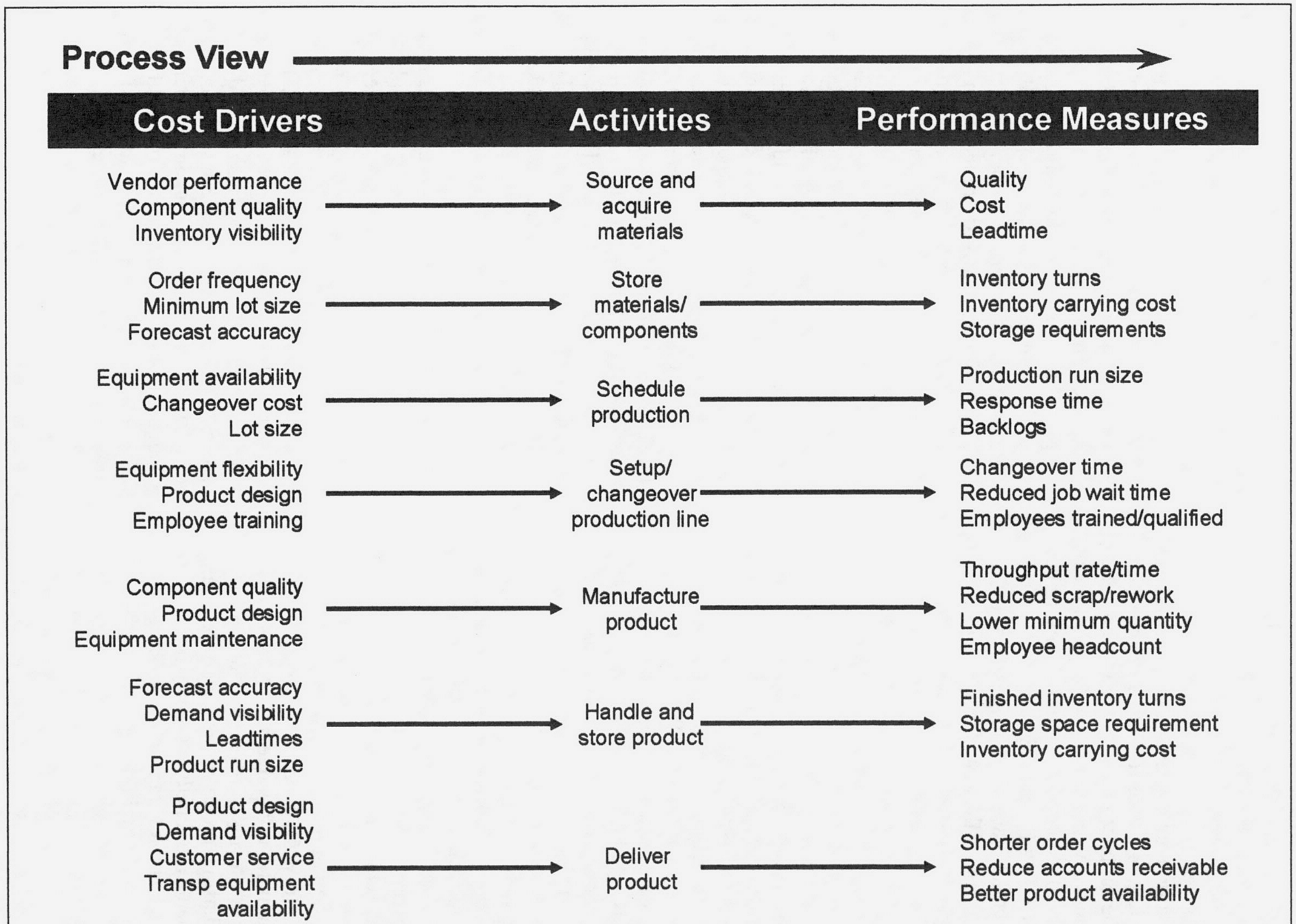
ABC provides the necessary mechanism to link operational measures (shown in the performance measure column) in Figures 2 and 3 with the associated value drivers and financial measures shown in those figures. The measures and cost information obtained through ABC are traced to each of the value drivers, as illustrated by the large arrows. The linkage demonstrates how improved performance at the activity level leads to value creation and increased profitability at the corporate level. The cascading of objectives to value drivers to operational measures ensures the alignment of intrafirm performance with interfirm strategy. It also promotes more effective communication by identifying exactly what each individual must accomplish to meet corporate and supply chain objectives. The framework enables operations managers to work backwards from the objective to reconfigure processes, redistribute activities, align performance, measure progress, and demonstrate improvement in profitability.

5. Measure and expand analysis to other trading partners

Expanding the dyadic EVA analysis from the supplier-customer relationship to include trading partners across the entire supply chain enables management to see how each firm contributes to achieving supply chain objectives and whether corporate behavior is properly aligned to improve performance and generate additional value. A dyadic upstream and downstream view is necessary to allow the manufacturer's leadership team to fully evaluate initiatives or proposals. For example, suppose the manufacturer is asking a tier 1 supplier for reductions in delivery quantities and quicker response to synchronize with the manufacturer's objective of smaller production quantities. The tier 1 supplier maintains that comply a significant investment is required to move distribution centers closer to the manufacturer. This will entail an associated price increase. If viewed myopically, the manufacturer simply could not capture the true value of a new arrangement, nor could they determine what a reasonable price increase would be. Using a dyadic EVA analysis, the manufacturer could assess the impact of the investment for the supplier, could examine the value drivers (e.g., lower raw material inventory) generated for itself by the results of that investment, assess the resulting EVA changes, and in the process assess the EVA impact that would be passed along to its own customers. Only then could an appropriate decision be made.

Extending the dyadic EVA analysis beyond the supplier-customer dyad to include multiple trading partners provides several benefits. Managers can measure how effectively each firm has implemented the strategy and the supply chain's effect on shareholder value. Operations managers across multiple companies can identify opportunities where collaborative action could increase sales, eliminate duplicating or non-value-added activities, and reduce inventories. Executives obtain a better understanding of how their decisions affect upstream or downstream performance and costs. The focus shifts from negotiating lower prices and driving cost reductions to how to increase value for the end-user and the entire supply chain. An extended analysis also provides a more appropriate vehicle for assessing whether an equitable allocation of costs and benefits has occurred across the supply chain.

Although the previous discussion illustrates the effects of implementing one type of operations initiative within a supply chain, a similar process could be followed to analyze any



Adapted from Turney, P. B. B. (1991), *Common Cents*, Hillsboro, OR: Cost Technology

Figure 5: Activity-Based Management—the Horizontal, or Process View, of Activity-Based Costing

operational changes made by any trading partner, including just-in-time (JIT), quick response (QR), flexible manufacturing systems (FMS), distribution requirements planning (DRP), material requirements planning (MRP), Six-Sigma, statistical process control (SPC), zero quality control (Shingo, 1986), collaborative planning, forecasting, and replenishment (CPFR), vendor managed inventory (VMI), sole/single sourcing, or concurrent engineering (CE, involving the supplier in product development). This is particularly recommended for initiatives that span the boundaries of multiple firms, as do JIT, QR, VMI, CPFR, and CE.

Working collaboratively with suppliers and customers on any of these will result at a minimum in ripple effects on EVA across a supplier-customer dyad and likely beyond to further branches of the supply chain. Quality improvement initiatives like CE, SPC, Six-Sigma, or zero quality control improve the ability to deploy new, innovative, higher-quality products faster than the competition. The customer's sales rise with increased market share and penetration into new markets resulting from the sale of new or better products, thereby producing additional sales revenue for the supplier. The exchange of information associated with CPFR will reduce cost-of-goods sold for a supplier through better production planning, ordering of materials, and workforce utilization. The customer's cost-of-goods sold can also decline as the supplier passes along cost savings. The supplier's current assets decrease as it holds less inventory due to improved forecasting and production scheduling. Accounts receivable may also decrease as the customer agrees to faster, electronic payments in return for off-setting cost reductions. Fixed assets decline due to improved scheduling and better utilization of plant, equipment, and warehouse assets. In VMI, expenses decrease as the supplier eliminates non-value-added activities between the two firms: sales people no longer call on purchasing, orders are received electronically, shipments are scheduled to maximize truckload rates and leverage cross-docking opportunities, and warehousing and handling of finished goods inventories are reduced (Pohlen and Goldsby, 2003). The customer's current assets drop as the supplier assumes inventory ownership, and the customer's fixed assets drop through eliminating distribution centers and material handling equipment. Some customer expenses may increase if the supplier must be paid more quickly, or if it must purchase technology necessary for communicating with the supplier.

Implementation Issues

Several issues will confront managers attempting to implement the dyadic EVA and ABC framework. For example, other trading partners may be unwilling or unable to exchange the information needed to support the implementation of supply chain initiatives. However, this can be overcome by identifying common goals and providing objective information to a reluctant trading partner. In a value chain analysis examining interfirm relationships, Dekker (2003) found that improved discussion of outcomes and possible courses of action increased the interaction between trading partners. The objective nature of cost information eased communications and negotiations. As the consequences of changes in supply chain operations became more transparent, the trading partners perceived less risk that they would end up with inequitable outcomes or having their shares of the benefits appropriated. This approach applies even when the firms do not exchange financial information (Dekker and Van Goor, 2001). The ability to demonstrate the direction and magnitude of value creation provides a compelling argument for change. The dyadic EVA analysis does this by identifying mutually desirable objectives for the supply chain and providing objective information regarding the effects of changes in cost and performance on the affected trading partners.

The need to generate immediate results may preclude managers from investing in supply chain initiatives when there is a lag between investment and the subsequent benefits, even for changes with high payback. EVA overemphasizes the need to generate immediate results (Brewer, 1999), and increasing investments in assets has a negative effect on EVA-based metrics. The costs and expenses associated with any initiative are recognized when incurred; however, the associated benefits may not be realized for several years. The inability of some firms to accurately assign the benefits and costs to a specific supply chain initiative further exacerbates the situation. Managers can partially overcome this issue by using the framework to demonstrate how, over the longrun, supply chain investments will create value for the firm. However, without a balanced set of metrics that emphasize and reward investment in innovation and process improvement, EVA-based measures could act as a disincentive to managers weighing projects that do not provide immediate returns (Brewer, 1999).

The dyadic EVA and ABC approach may also produce a bias toward the development of financial and cost-based performance measures. The integration of EVA and ABC with the balanced scorecard (BSC) can overcome this situation. The BSC overcomes the limitations of managing only with financial measures (Davig, Elbert, and Brown, 2004). The BSC framework ensures a balanced set of measures by viewing performance from four perspectives: financial, customer, internal processes, and innovation and learning (Kaplan and Norton, 1992).

Robert Kaplan (2001), one of the principal architects of the BSC, argues that the BSC, EVA, and ABC are highly compatible and that organizations can greatly benefit from their integration. EVA takes into account the quantity of capital used to generate financial returns and can be used to organize the financial perspective of the BSC. However, EVA must be combined with other approaches, such as ABC, that can analyze activities and translate non-financial into financial performance. The first stage of ABC assigns the resources consumed in performing the activities and processes within an organization. Kaplan suggests the activity costs can be directly linked to the internal processes perspective in the BSC. The activity-based information demonstrates how reducing setup time and employing flexible manufacturing affects costs and process performance. The subsequent assignment of activity costs to determine cost-to-serve, supply chain profitability, or customer profitability, provides a linkage to the customer and financial perspectives of the BSC. ABM provides the link to the fourth perspective, innovation and learning, by identifying the factors that drive activity costs such as product design, employee training, and new product development, and the measures for assessing activity performance: percent of employees qualified/trained, change-over time, quality, and number of new product introductions. The BSC can integrate ABC, EVA, and ABM into a single framework that provides a balanced perspective between financial and nonfinancial results as well as long-term versus short-term performance. However, the BSC has been used only to integrate intrafirm performance measures, and its application across multiple firms requires further research.

Conclusion

Successful supply chain management ultimately comes down to the ability to create more value than the competition. The configuration of firms, processes, and activities composing the supply chain drives value creation. Operations managers and senior executives confront the problem of determining the configuration yielding the greatest value for the end-user and each trading partner. They need to evaluate how the operational capabilities of each firm contribute to attaining supply chain objectives and the level of value created. The value of collaborative action must be measured and sold across each link to obtain trading partner buy-in and to align intrafirm performance with supply chain objectives. Despite the need to measure and align performance across multiple firms, most managers view performance from an internal perspective, or at best, how it is affected by their immediate upstream or downstream trading partners. Complexity and the interdependent nature of the supply chain make interfirm performance measurement extremely difficult; however, firms that act first to apply interfirm measures and align their performance with supply chain value objectives will achieve a sustainable advantage their competitors may be unable to emulate.

Dr. Pohlen, who retired from the U.S. Air Force with over 20 years of logistics experience, has published in leading logistics journals. His articles focus on the costing and financial management of logistics and supply chain performance measurement. Dr. Coleman is actively involved in research on the mathematical modeling of managerial decisions and has published over 40 articles.

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