Supply Chain Decision-making  
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Executive Summary

A large collection of tools, technologies, and methodologies is being thrust on executives today in every area of business, including the supply chain management space. Seminars and books abound. Periodicals are everywhere. “Solutions” proliferate. A comprehensive perspective that will organize and categorize the good, the mediocre, and the bad remains elusive. Yet, increasing the value of the corporation stands as an unyielding objective. Executives must answer this question: “How much consistent positive pressure will a given initiative exert on the value of my company?”

Higher value for the enterprise often resides dormant in the supply chain. It is there for the taking for those executives who can see through the fog of propaganda and the plethora of possible projects to focus with clarity. The catalyst of executive support must be applied with precision in order to improve supply chain decisions. These decisions drive operational capabilities that result in financial metrics, which, in turn, determine corporate performance. Specifically, the quality of the decisions pertaining to inventory and supply chain flexibility reflect in the value accrued to the enterprise. Figure 1 traces this linkage, borrowing from a financial perspective on the balanced scorecard concept.¹

Figure 1.
These inventory and feasibility decisions determine the position of the fulcrum for the supply chain lever (Figure 2). More timely and higher quality decisions in the “optimize inventory” and “optimize supply chain flexibility” spaces (boxes outlined in yellow under "Supply Chain Decisions" in Figure 1) move the fulcrum in Figure 2 to the left. This amplifies the force that supply chain capabilities exert on key financial metrics, creating more Economic Value Added\(^2\) (box with yellow outline at the far right in Figure 1).
Benefits of Improving the Decision Process

Consider the challenge faced after a merger or acquisition. The challenge of rationalizing warehouses, distribution centers and even production facilities is a decision in the supply chain flexibility space. The rationalization exercise is non-trivial, but can drastically impact cash flow, as well as balance sheet and income statements. In the inventory decision space, globally deciding what to move, make and buy in a way that recognizes the various risks can enable a firm to lower its purchase price, eliminate expediting costs, free precious cash flow, and improve customer service.

This is not to say that other business improvement projects cannot enhance corporate performance. Interdependencies among all facets of the business imply that a focus on one area to the detriment of others will not succeed. For example, without a strong product strategy, effective target marketing, and appropriate pricing, supply chain efficiency and effectiveness will be insufficient to increase enterprise value. The point here is that providing you have a minimum level of efficacy in marketing and transaction capabilities, improving the decision process around inventory and supply chain flexibility will drive sustainable, measurable benefits in the near term that are disproportionate to the effort required.

It is assumed, of course, that the decisions made are executable. In many cases, the most important supply chain decisions can be actionable, even without new execution systems for order management, warehouse management, purchasing, costing or accounts receivable. In
cases where good decisions cannot be executed because basic business transactions are not accurate or timely, then the sustainable viability of the business may be in question. A sustainable increase in valuation must give way to a fire drill for survival.

**Keeping Perspective**

**Corporate Objectives**

All MBA graduates have been taught to accept the tenet that the object of management is to increase shareholder wealth. Presumably, the interests of all of the other stakeholders could, or even should, be subjugated in favor of shareholder wealth. One might argue that as shareholder wealth increases, all other interested parties benefit. Another point of view might be that, while the interests of all stakeholders may not be of equal import to management, they should all be considered, and that in doing so, shareholder wealth will be enhanced over the long term. For the purposes of this discussion, it is assumed that the objective is, indeed, to increase shareholder wealth -- to increase the value of the enterprise in which the shareholders have invested, and therefore, the value of their shares.

**The Nature of the Supply Chain**

Before launching into the logic behind the thesis in this article, it is in order to review the concept behind a term that has very much come into vogue (and into some abuse as well), namely, supply chain. There are three basic functions in a typical business organization: finance, marketing, and production/operations, excluding support and infrastructure. Stevenson\(^3\) describes all of the activities that are directly related to producing goods or providing services as part of operations. He defines operations as activities that add value during the transformation process into which inputs are received and from which outputs are delivered. Inputs and outputs can be products, services or information. The people and assets involved in acquiring the inputs and performing and delivering the transformation make up the supply chain.

That a supply chain stretches beyond a lone enterprise is not news. Organizations have always received inputs from a supplying entity and delivered outputs to a consuming company or person. Each organization provides an interdependent link in the value-adding transformation process, otherwise known as the supply, or value, chain. In fact, this is seldom a single “strand” of activities, but rather an interdependent network comprised of many value-adding nodes, each of which receives many inputs and combines them in various ways in order to deliver numerous unique outputs for multiple consuming nodes. Organizations that receive outputs (customers) pay for the value added in the transformation process. It is, perhaps, more properly designated the value network through which many value or supply chains can be traced.
If each node in the value network makes decisions in isolation, the potential grows for the total value in one or more supply chain strands to be less than it could be. In the best of all possible worlds, each node would eliminate activities that do not add value to its own transformation process such that it can reap the highest possible margin, subject to maximizing and maintaining the total value proposition for a supply chain. This is the best way to ensure long-term profitability, assuming a minimum level of parity in bargaining position among trading partners and in advantage among competitors.

Of course, in the real world, that scenario fails for several reasons. First, the forces of entropy and human frailty and the unpredictability of events enforce some level of non-value added activities on all organizations. Second, each node does not have an equal sphere of influence. The relative bargaining power of each organization can be quite different, resulting in a price (and margin) that is directly related to its bargaining position. Further, a poor bargaining position may mandate that an organization bear a disproportionate share of non-value adding activities. Third, learning and technology sometimes advance in stepwise fashion so that new ways of adding value make old ways wasteful by definition. Since such new advances do not meet with universal, simultaneous and continuous adoption, non-value added activities persist at some level in all supply chains.

All of this is to illustrate that the ideal purview of decision-making in the supply chain has always been larger than one’s own organization or enterprise. By definition, eliminating non-value adding activity in the supply chain through better decisions necessitates some level of collaboration with other organizations in a value network. How far this can extend, how effective it will be, and the impact on margins (local and for a supply chain) are determined by industry structure, access to information, technological advances, and other factors.
Financial Metrics that Equate to Corporate Performance

Corporate performance has been defined in numerous ways. Economic Value Added (EVA®), Economic Profit, Owners Earnings, Residual Income, and Economic Value Management are intended as comprehensive evaluations of corporate performance. Other measures such as return on investment (ROI) and earnings per share (EPS) can leave out the cost of the capital required to achieve the return or earnings. Economic Value Added illustrates a measure of comprehensive corporate performance that is determined by the combination of financial metrics shown in red in Figure 3. (For an alternative example, see the Appendix.)

In its simplest form, the formula for EVA® can be reduced as follows:\(^1\):

\[
\text{EVA} = \text{Return on Net Assets (RONA)} - \text{Weighted Average Cost of Capital (WACC)}
\]

where

\[
\text{RONA} = \frac{\text{Net Operating Profit after Tax (NOPAT)}}{\text{Net Assets}}
\]
NOPAT = Net Sales less Operating Expenses and Taxes

Net Assets = Cash, Working Capital and Fixed Assets
or
Total Assets less Current Liabilities and Financial Assets

and

WACC = E/V x Re + D/V x Rd x (1-Tc)^2

Where:

Re = cost of equity
Rd = cost of debt
E = the market value of the firm's equity
D = the market value of the firm's debt
V = E + D
E/V = percentage of financing that is equity
D/V = percentage of financing that is debt
Tc = the corporate tax rate

The numerator for RONA is profit, so RONA is heavily influenced by revenue and costs. Therefore, managing both revenue and costs is critical to overall performance. Taking a very simplistic point of view, total costs include both Cost of Goods Sold (COGS = the costs of inputs, adding value through the transformation process, and delivering the product/service bundle) and Sales, General and Administrative (SG&A) costs.

The Weighted Average Cost of Capital reduces to summing the product of the cost\(^3\) of each capital component and the proportion of total capital that each component comprises. WACC has two impacts. The first is to the income statement and cash flow. For example, interest on loans that provide money to purchase inventory has to be paid. The second impact relates to the balance sheet. Since invested capital comes from banks, bonds, and the equity market, having too much capital tied up in inventory may mean that a company must raise additional capital and pay a higher price for that capital or forego new investments or enhancements to operations.

1 O'Byrne, Stephen F. and Young, S. David, EVA And Value Based Management (McGraw-Hill, 2001) pp. 34 – 46.

2 http://www.investopedia.com/terms/w/wacc.asp

3 Costs for debt are relatively easy to identify. The cost of equity is more challenging and can only be estimated based on the return demanded by investors.
Supply Chain Capabilities Drive Financial Metrics

If the key financial metrics for creating corporate value relate to costs, capital charges and consumption, and profitability, then the corporate capabilities or competencies required to drive those metrics must include controlling supply chain costs, managing supply chain cycle time, and optimizing responsiveness to the marketplace (Red boxes in Figure 4). These capabilities are developed through decision processes that are competent in the areas of inventory and supply chain flexibility. In addition (and in contrast) to the linkages from supply chain capabilities to financial metrics, decisions that optimize inventory are directly linked to the effect of financial leverage on EVA®.

Figure 4.

Supply Chain Capability #1 - Reduce Supply Chain Costs

Companies incur supply chain costs in the course of conducting the three main operating activities—procurement, transformation and delivery. As previously noted, these activities may involve not only materials, but also services and data or information. As information technology has advanced, the transformation and, in particular, the delivery of information have blurred the traditional demarcation between the acquisition of orders and the fulfillment of orders. For example, committing to orders might once have been clearly a marketing or sales activity. However, information technology now empowers the ability to commit to a customer order in real time, at any time during the day, considering not only
on-hand inventory, but also real production capability so that the activity of acquiring the
order and the activity of fulfilling the order are becoming more closely coupled.

Many supply chain costs are not obvious. In spite of their subtlety, these costs can have a
dramatic effect on the bottom line. In addition, standard accounting practices often do not
capture these costs in a manner that would allow them to be classified with respect to the
value that they add. This has given rise in recent years to an interest in “activity-based
costing”.

Some of these costs include expediting costs such as premium freight or charges levied by
your suppliers when they have to perform an emergency schedule change and incur an
additional setup, all because your requirements have changed. Costs of poor quality have
been well documented by Juran, Deming, Crosby, and others4. The costs of a poor schedule
that incurs too many setups may not be so obvious. Another subtle set of costs includes the
costs to carry inventory. While the theory is sound and widely acknowledged, it is a class of
costs that are typically captured under other categories. All of the incremental charges you
pay to store, move, insure and pay taxes on inventory that isn’t selling are part of your
supply chain costs. The financing charges are part of the weighted average cost of capital
that is affected directly by inventory decisions.

**Supply Chain Capability #2 - Optimizing Operational Cycle Time**

For this discussion, the term cycle time denotes the total time elapsed from the time an
order is received until the customer can be invoiced or charged. In the case of post-sale
service, cycle time refers to the time from the identification of a need for the service until
the completion of the service. Cycle time can be decomposed into its components, including
procurement, manufacturing, packaging, distribution, and service.

Optimizing cycle time is the right way to think about this subject, rather than minimizing
cycle time. You optimize cycle time by gaining insight into the tradeoffs between economy
of scale and rapid schedule changes. This tradeoff is often most dramatic in manufacturing,
but it is also relevant to procurement, warehousing, and transportation. Some actions
reduce cycle time, but decrease economy of scale. More frequent machine setups can yield
this result. But if the cost and time required for a setup are reduced, then the negative
impact on economy of scale can be negligible.

Consider another example. Developing the ability to plan multiple less-than-truckload (LTL)
shipments together into an integrated TL with a smart route and reverse loading creates
some economies of scale, but also has the potential to increase delivery cycle time.

Visibility into your customers’ requirements, and providing visibility into your requirements
for your suppliers will help to reduce cycle time. For example, if your customer changes an
order at the last minute, there is a high probability that some days, perhaps even a week or more, passes before you know that such a change is happening. During this time, you could be planning the best way to accommodate this change (or even a potential change) while meeting all of your other requirements and managing cost. However, as time continues to pass, the cumulative effect of the decisions you make based on the fallacious assumption that your customer’s requirements are not changing increases the risk to your operational effectiveness and efficiency, should you have to adjust suddenly to a change in requirements. This latency in awareness equates to a risk to operations and exists in direct inverse proportion to the visibility that you have into your customer’s requirements. Opaque barriers to such visibility may mean that you need to stop production on one product, store the converted and unconverted inventory as work-in-process (WIP), possibly in outside storage, and complete a setup for another product. Shipping schedules may have to change. Slotting and staging activities in the warehouse may be disrupted. You may even have to negotiate with your suppliers to do the same, particularly, if they don’t have visibility into your plans.

Information is a partial surrogate for time. The sooner that information regarding changing requirements can be known, and the more complete that information is, the more likely it is that members of supply chains in a value network will be able to plan around these changes with the least impact to cost.

**Supply Chain Capability #3 - Responding to the Marketplace**

Responding to the marketplace means several things. First, preparing to respond is something that all companies do. Every organization must plan in an attempt to anticipate market requirements before they happen. Capital has to be allocated. Staff must be in place. Suppliers should be identified. Planning for demand is a fact of business.

Second, the company must develop a product and service bundle that will find paying customers in sufficient number at a price that yields a proper margin.

Third, responding to the marketplace means being able to have the right product, in the right place, at the right time, at the right quality, for the right price so that the service level achieves an economic optimum. In other words, the service level should be such that the combined risk of the economic fallout from missed, reduced, or cancelled orders, and of having too much capital tied up in inventory or excess capacity is minimized.

Finally, in the circumstance where demand outstrips the ability of a company to meet every order on time, the product mix should be such that it meets the corporate objectives, which may include maximizing margin, satisfying the most important customers, shipping the most product on time, or satisfying the most customer orders on time.
Figure 5. - Causal Metrics Matrix

Quality decisions relating to inventory and supply chain flexibility (red boxes in Figure 5) cumulate to set the level of capability that your organization (and value network) can achieve in the three supply chain capabilities previously discussed:

- Reduce costs
- Optimize cycle time
- Respond to the marketplace.

Decisions to Optimize Inventory

Decisions regarding the timing and quantity of stock that is procured, manufactured and stored have a very significant influence on supply chain costs, capital availability and the cost of capital, various cycle times, and market response. For example, targeting inventory supplies so that organizations synchronize the planning and execution along an entire supply chain strand in a value network to produce an appropriate inventory of goods that is where customers need it, when they need it, at a competitive price that yields a good margin will reduce supply chain costs. Expediting costs (premium freight, vendor surcharges) and late charges will be reduced. Costs will not be incurred to carry inventory that will not move. Funds will not be spent on materials, transformation and transportation in vain.

4 Crosby, Philip B., Quality is Free: The Art of Making Quality Certain, (McGraw-Hill, 1979)
Deming, W. Edwards, Out of the Crisis, (Massachusetts Institute of Technology, Center for Advanced Engineering Study, 1986)
Good inventory decisions also improve cycle time. A long machine run that is producing too much inventory and spending capacity needlessly can impede manufacturing cycle time if sound decisions are not driving how much of what to make and when, while controlling the quality of the process. Poor decisions fill warehouses and other storage areas with goods and material that is not currently needed or of poor quality, making quick access to inventory that is needed more difficult.

**Supply Chain Flexibility Decisions**

Decisions about the flexibility of the supply chain determine the capability to optimize supply chain cycle time. Fundamentally, increases in flexibility require a reduction in fixed costs and/or in fixed times. Fixed costs include machine setups, minimum quantity purchases, lot or batch sizes, dedicated capital equipment, manufacturing and distribution facilities, and the like. Decisions you make related to the assortment of products and services that can be delivered through a given set of resources, the mobility with which you can switch among the selections in that assortment, and the consistency of performance (or quality) for a given range of operations will determine the effect of fixed costs on supply chain flexibility. The science of strategic cost and opportunity analysis rationalizes product and market mix with the possible combinations of facilities and equipment. This helps to determine supply chain flexibility and to produce opportunities for increasing return on net assets, and freeing working capital.

Decisions to share planning information among nodes in a value network drive fixed time constraints in the supply chains of which you are a part. Elimination of latency through visibility of requirements across the value network allows proactive managers at all tiers to see challenges before they arrive and plan to meet them with minimal risk.

Smart inventory policies enable supply chain flexibility. Flexibility remains challenging if you move, make or buy too much of the wrong material. Capital isn’t available. Facilities and equipment are clogged. Similarly, decisions in the area of flexibility enable better inventory decisions. If setups are faster and cheaper, or minimum batch sizes are smaller, inventory decisions can be more precise.


**From Theory to Practice**

Perhaps the most famous examples of supply chain decisions contributing to corporate performance are Dell and Walmart. Both companies have systematically attacked the decision processes around inventory and flexibility with remarkable results. Dell has increased its return on invested capital from 154% to 325% from 1997 to 2001. Days of supply in inventory have decreased from 13 to 5 over the same period of time. While
Walmart’s return on assets and return on shareholders’ equity has declined marginally over the last couple of years, they are still impressive at 8.55 and 20.1%, respectively\(^3\). But these examples, while famous, are not alone.

The linkages outlined above mean that improvements in the decision-making process will yield a positive and significant impact on corporate performance. A large television manufacturer in Eastern Europe implemented an advanced planning software package as part of an effort to make better, more feasible, synchronized decisions around the procurement and manufacture of inventory. As a result, on-hand inventory was reduced by approximately $50 million. The balance sheet changed as a result, reducing the marginal (and thereby the weighted average) cost of capital and freeing cash for other uses. Since the cost of capital is a part of the equation for any measure of overall corporate performance, the value of the enterprise increased as a result.

While decisions can be achieved without the implementation of new software in many cases, the complex nature of supply chain decisions, as well as the sheer number of individual obligatory decisions make the use of advanced planning software tools helpful. A large, multi-site manufacturer in Asia implemented such a package and found that they could produce significantly more finished product with the same capacity. This will enable the manufacturer to grow the business, creating the potential to increase market share by 50%. The impact on corporate performance is easy to trace in Figure 3. More sales from the same assets equate to a higher return on net assets (RONA) and, as a result, a higher EVA®.


**Conclusion**

There remains no shortage of experts and solutions that purport to have the keys to improving your supply chain. In point of fact, many of these experts and solutions may have their place. However, executives who bear bottom line responsibility for the performance of the enterprise would do well to evaluate every potential new program from the perspective outlined here. The crucial questions are these:

1. Will a particular program enable the people in your organization to make significantly better decisions in less time with respect to inventory and supply chain flexibility?

2. If so, how will improved financial performance result through improved supply chain capabilities?
An affirmative answer to the first question may be intuitive. However, some detailed analysis is usually necessary in order to gain an understanding of undesirable symptoms in your supply chain and the root causes of those symptoms. For example, one undesirable symptom might be excessive premium shipping costs incurred by the shipper. Another might be lost or reduced orders. Potential root causes for the former could be an inability to synchronize various planning activities or poor transportation decisions. The latter could be caused by a failure to gain visibility into your customers’ requirements, underutilizing the power of mathematics to optimize inventory decisions, or poor order promising.

The answer to the second question requires a grasp of the linkage between capabilities that you need to develop (fixing the root causes) and the eventual impact on the financial measures outlined above. As a case in point, consider that having stock available when and where it was needed through improved inventory decision-making may eliminate the need for customers to look to other vendors when you are unable to meet their requirements. Further, vendor charges for additional, emergency setups can be reduced by making the strategic decision to gain visibility into your customers’ plans (a flexibility decision). While excess premium freight impacts supply chain costs, reduced and cancelled orders affect revenue. Combined, these undesirable symptoms reduce profitability, driving down RONA and reducing EVA®.

Improving your ability to decide how much stock of each item to move, make and buy at each location can affect both symptoms. Collaborative planning with your customers can improve the flexibility of your operations, also affecting both symptoms. An example of how negative symptoms, root solutions, and the financial measures affected relate is shown in the Causal Metrics Matrix in Figure 4. All of the rows in the matrix relate to inventory decisions, flexibility decisions, or both.

The importance of a foundation of competence in business fundamentals has endured the business buzzword mania of the last few years. Management of the supply chain has always
been a competency that is fundamental to increasing the sustainable value of an enterprise. Prioritizing the issues indigenous to supply chain management elevates inventory and flexibility as primary in importance. By focusing on decisions that involve inventory and operational flexibility, you can reap rewards that are disproportionate to the effort required.


2 - EVA is a registered trademark for Stern, Stewart & Co.
