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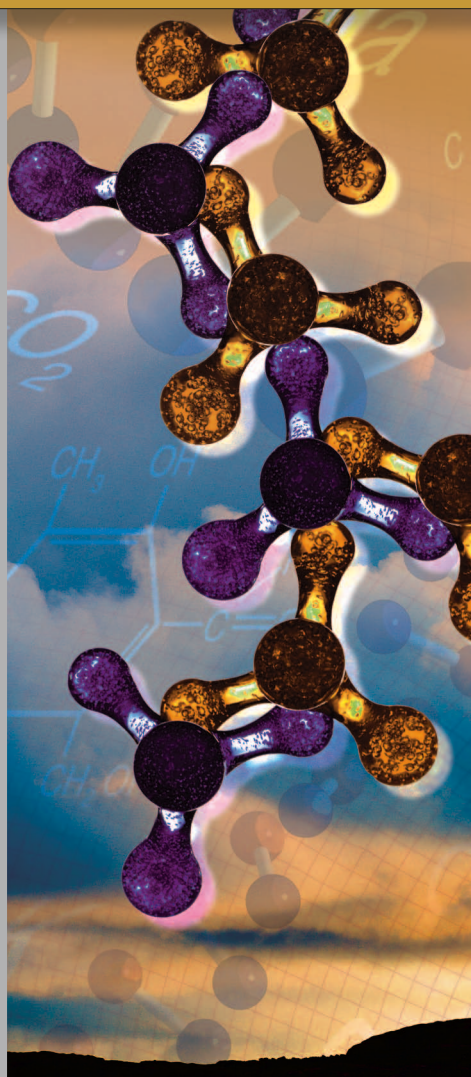
End-to-End Commodity Management in the Chemical Industry

A comprehensive approach from sourcing to pricing



The chemical industry recently experienced significant turbulence, as volatile prices for petrochemicals played havoc with profit margins. Leading companies, however, weathered the storm using supply market knowledge to develop effective sourcing, pricing and risk management strategies, extracting 25 to 50 percent more value from their direct material spend than the average company. Under more stable conditions, that capability would be a source of competitive advantage—but in today's markets it can mean the difference between success and failure.

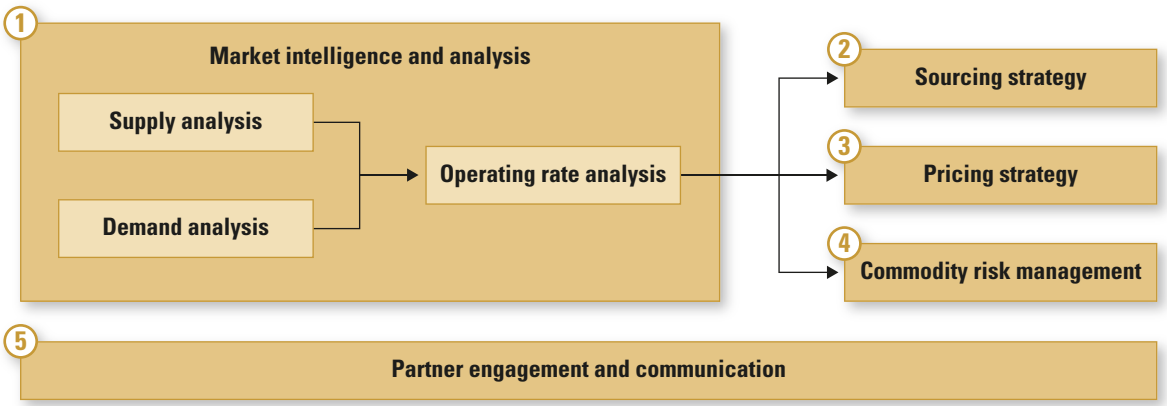
In 2008, price volatility made managing profit margins a challenge for chemical companies. On the supply side, the price of crude oil swung from $90 per barrel in January, up to more than $140 per barrel in July, and then back down to $40 per barrel in December. These wild swings had a direct impact on the price of naphtha and other petrochemical building blocks used to produce a range of downstream chemicals. At the same time, the collapse of the housing market, the drop in auto sales and the general economic downturn led to a steep decline in demand for chemicals in the fourth quarter. These two forces—raw material price volatility and demand uncertainty—made it difficult for chemical companies to effectively structure both purchasing and sales contracts. As a result, companies often had to absorb the higher cost of raw materials when prices rose, and were unable to benefit when prices fell.

Managing commodities end-to-end is the best way for chemical companies to protect margins in today's volatile environment. However, this can be challenging given the complexity and interconnectedness of chemical value chains, the analytics required to develop market projections, and internal organizational constraints. We have developed an end-to-end commodity management approach, consisting of five elements, to manage the spread between raw material costs and product prices and thus gain competitive advantage *(see figure 1 on page 2)*.

Managing Commodities: An End-to-End Approach

At the heart of the approach is market intelligence and analysis, where projections of supply and demand balances are developed. These projections are then used to create sourcing, pricing and risk management strategies. Engaging and

Figure 1
End-to-end commodity management



Source: A.T. Kearney

communicating with partners is the key enabler required to share information, make decisions and put strategies into action. To illustrate this end-to-end approach, consider the hypothetical chemical company, ChemCo, shown in figure 2. We'll use this example company throughout the paper. As you read, you may find it helpful to substitute the fictitious names used here with real products from your company.

ChemCo produces a product called "polymer" that is sold in different end markets. The key raw material in polymer, which we'll call "intermediate," is produced from two other "building block" chemicals. Since intermediate represents a large portion of polymer's cost structure (typically between 25 and 50 percent), managing the intermediate purchase holistically is crucial for the profitability of the polymer business.

The following highlights each element in the end-to-end approach as it relates to ChemCo.

Market intelligence and analysis. Market intelligence and analysis is where projections of supply and demand balances are developed over multiple time horizons. For ChemCo, the price of intermediate is determined by total costs and margins, as shown in figure 2. Total costs are in turn driven by the price of building blocks 1 and 2; margins are determined by intermediate's supply and demand balance. Thus, the market analysis focuses on the entire value chain—the product being purchased (intermediate), its precursors (building blocks 1 and 2) and end markets (polymer and other applications). Data is analyzed over three different time horizons: near term (less than two years), mid-term (two to five years) and long term (five or more years). The market analysis consists of three steps:

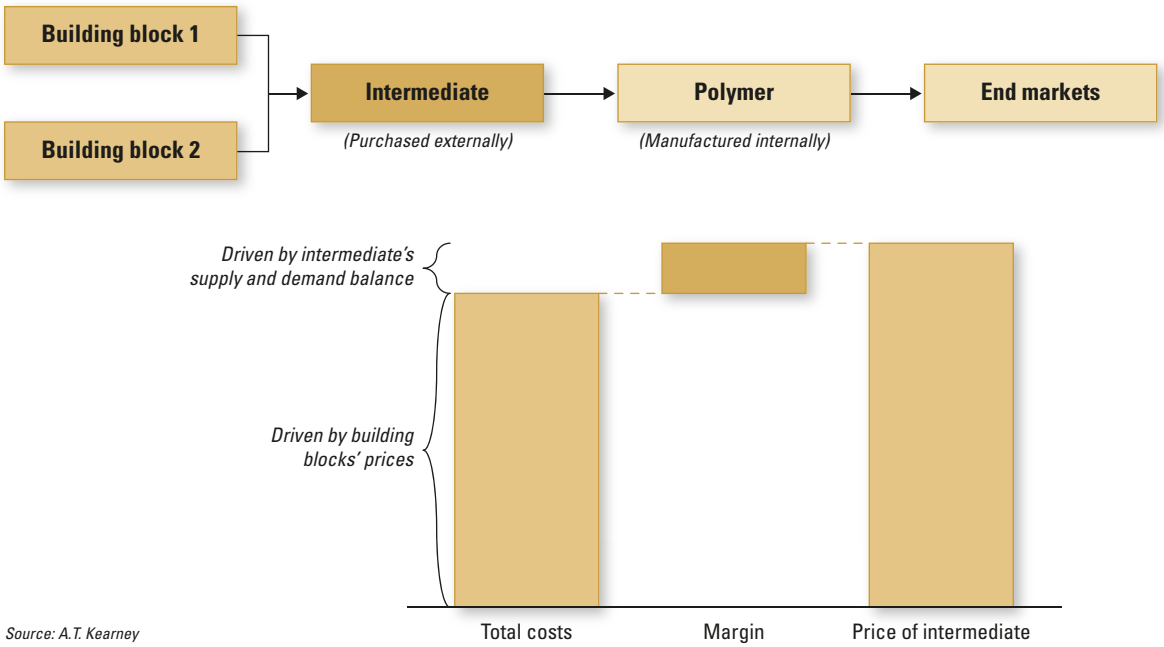
Supply analysis. Commodity chemicals are either produced "on purpose" or as a co-product of another chemical's production process. When the commodity is produced on purpose, analysis involves researching current supplier capacity, future capacity (additions and closures) and debottlenecking initiatives. When the commodity is a co-product, or if there are alternative uses for the commodity, estimating supply becomes more

complex. For example, the supply of caustic soda—a co-product of chlorine—is driven by demand for PVC and other chlorine derivatives. Propylene is another interesting example. In North America, propylene is produced from steam crackers and also from petroleum refineries that have other applications for propylene (such as propylene alkylate for use as a gasoline blend). Therefore the available supply of propylene depends not only on the state of the ethylene industry but also on the dynamics of the gasoline market. Given such interdependencies, it is important to conduct primary research and not rely entirely on industry reports.

Demand analysis. ChemCo's category manager for intermediate can begin analyzing demand trends by talking to company sales and business leaders. They can provide perspectives on polymer demand, customer buying behavior, and trends in end-use markets that consume polymer, such as automotive or construction. Primary and secondary research will shed light on the demand for intermediate in other downstream markets. This information can then be synthesized to develop a complete point of view on intermediate's demand development.

Operating rate analysis. Procurement can then develop the projected operating rate over time—that is, the percentage of total production capacity that is utilized at a given time. This rate will then be compared to the "critical operating rate" (COR) for the commodity. COR, derived from analysis of historical data, represents a point beyond which the marginal cost to produce

Figure 2
Hypothetical chemical company ChemCo



Source: A.T. Kearney

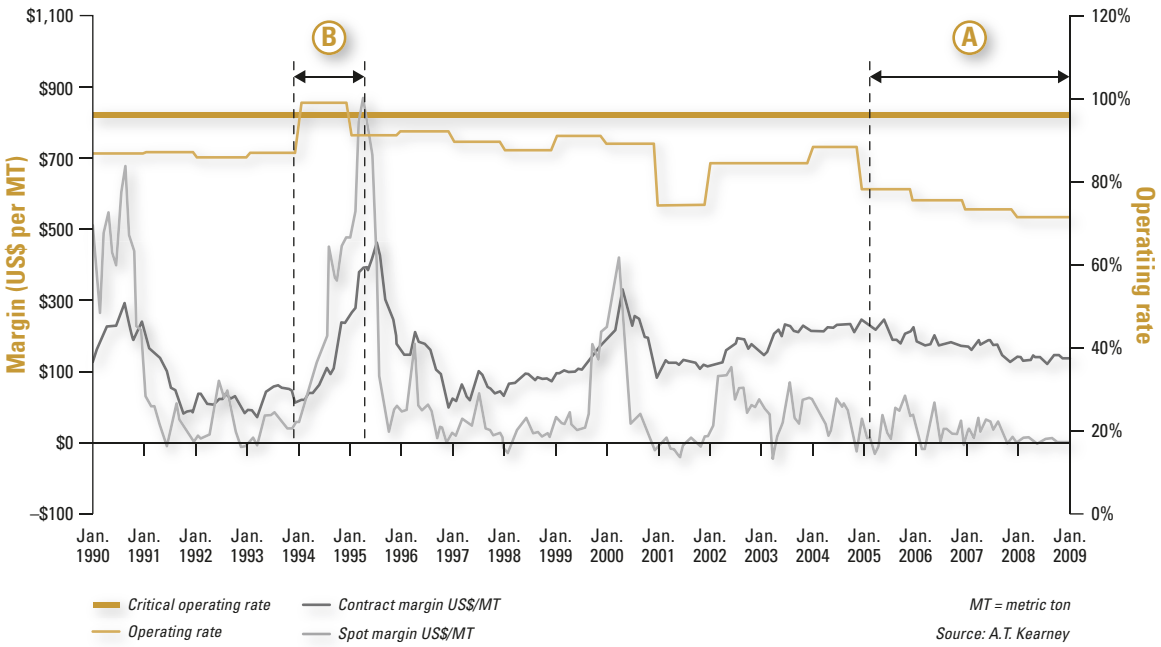
another unit of output rises drastically in the short run, thereby requiring much higher industry prices to cover the costs.[1] These higher prices for the incremental unit of output dramatically raise the overall industry margins. Our analysis across several commodities shows that the COR varies in value from 75 to 95 percent for different chemicals.

The industry margins for most commodity chemicals fluctuate around the COR, thus providing a reference point for evaluating the supply and demand balance. For example, in figure 3, during "time period A" the operating rate for styrene is significantly below the COR, which means that demand is relatively low compared to industry capacity, and consequently the spot margin is low. However, the contract margin is greater than the spot margin, since customers are willing to pay a premium for more secure supply.

In "time period B," the operating rate for styrene becomes larger than the COR, signifying that demand is high relative to industry capacity. This leads to a large increase in spot margin—since in a tight market customers must pay a large premium to secure product volumes. The contract margin also increases, although less dramatically than the spot margin, since the volumes are secured. Note that there is usually a lag of one or two quarters before a change in operating rate affects commodity margins.

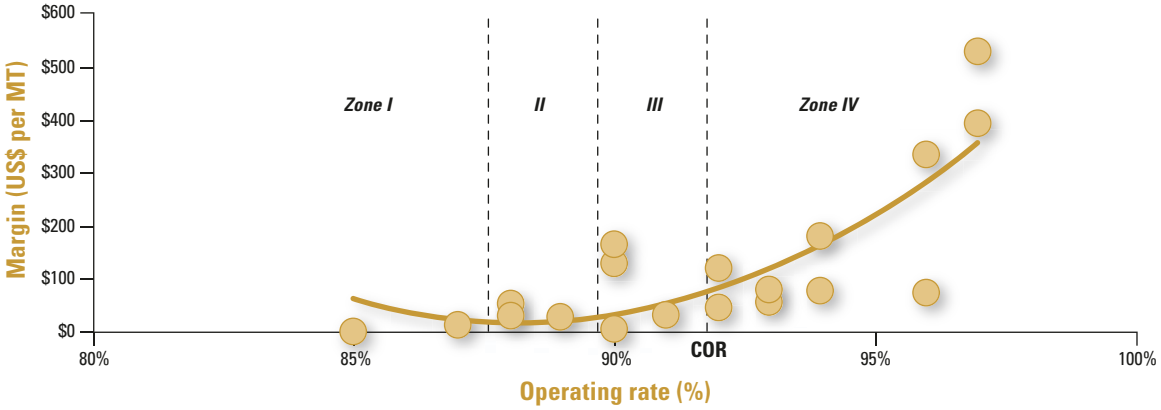
Understanding the COR is more important than ever in today's volatile chemical markets as qualitative and intuitive understandings of supply

Figure 3
Styrene operating rates and margin



[1] *Statistically, COR is a measure of the inflection point in the margin versus operating rate curve for a given commodity.*

Figure 4
Critical operating rate (COR) zones



Zones: I (significantly below COR), II (below COR), III (at or near COR), IV (beyond COR).

Source: A.T. Kearney

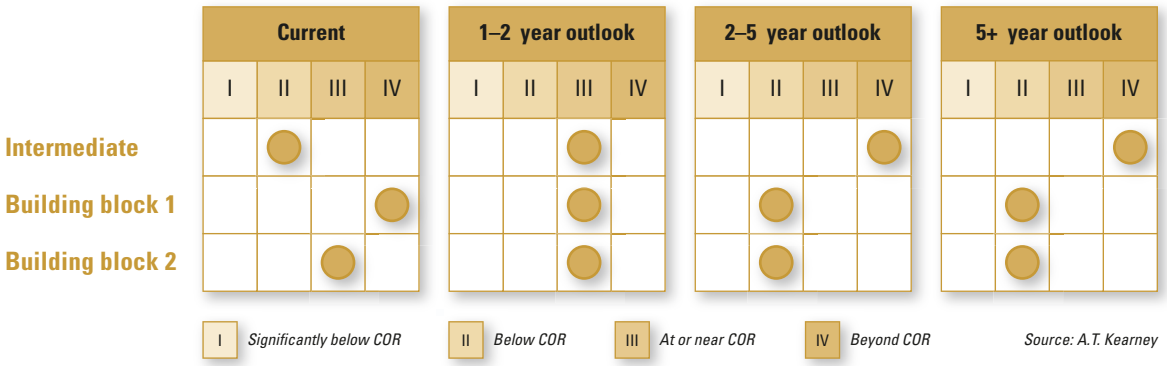
and demand balance are no longer sufficient. Companies that evaluate a market based on how close projected operating rates are to the COR will have a much clearer picture. For example, in figure 4, zone 1 is a "long" (well-supplied) market and zone 4 is a tight market. At ChemCo, this information would provide the analytical foundation to develop the sourcing strategy for intermediate, inform the pricing strategy for polymer, and manage the risk exposure for both.

Sourcing strategy. The second element of our commodity management approach is to develop an effective sourcing strategy with the right balance among three areas: contract and spot market purchases, the best pricing mechanism (fixed, cost plus fixed fee or market index less a discount), and the ideal contract terms and profile.

At ChemCo, conventional wisdom might hold that in a tight intermediate market, a cost-plus-fixed-fee contract is best, and in a long market, negotiating prices is best. While these rules may be directionally correct, they will almost certainly yield inferior results in today's markets. Instead, we would use the "commodity fingerprint" framework, shown in figure 5 on page 6. In this example, the intermediate market is expected to get tighter over the long term while the situation is the opposite for the building blocks. So, ChemCo should secure a long-term deal for intermediate to prevent supply shortages in the future. And to get the best price, a cost-plus-fixed-fee formula would serve well over the life of the supply agreement, since the building block markets are projected to go long. Also, the low operating rate for intermediate implies that current margins are low, so it should be possible to lock in a relatively low fixed fee for the duration of the contract.

Pricing strategy. Based on the commodity fingerprint framework, ChemCo's purchasing group advises its business partners on a pricing strategy to maximize the spread between polymer prices and intermediate costs. In figure 5, anticipating rising intermediate prices, ChemCo

Figure 5
Commodity fingerprint framework



moves to a cost-plus mechanism for polymer's sales contracts, and passes feedstock price increases on to customers more effectively. Likewise, when intermediate prices are anticipated to decline, moving to a quarterly or monthly negotiated price mechanism for the polymer product allows capturing greater margins.

Commodity risk management. After analyzing buy side and sell side contracts to identify risk exposure, procurement can combine these findings with the COR analysis and the commodity fingerprint framework. This will identify potential problems in the commodity markets. When risks are spotted, possible approaches include:[2]

Transfer risk. Move to a cost-plus pricing mechanism to pass feedstock price increases on to the customer.

Mitigate risk. Structure a portfolio of purchase contracts using different volume ranges and pricing mechanisms, while maintaining the ability to shift volume among suppliers to mitigate the impact of raw material price changes. Also, consider financial hedging.

Avoid risk. Take ownership of supply sources (backward integration) to secure supply and avoid raw material price risk.

Respond to risk. Implement pricing changes after shifts in raw material market prices.

Partner engagement and communication. Making commodity management a team effort is key to our end-to-end commodity management approach. Stakeholders who meet regularly—perhaps even monthly when dictated by market conditions—will help ensure that supply and demand projections are up to date. Stakeholders include *business leaders*, who will be informed about cost structure and risk exposure so they can make informed business strategy and investment decisions. *Sales professionals* will be able to price products to maximize margins. *Purchasing leaders* can better evaluate cost benefits and sources of value beyond cost (such as risk management). Finally, *category managers* will be equipped to discuss the impact of raw material price changes with suppliers.

[2] *For a more thorough discussion on risk management, see "Bringing Rigor to Risk Management" by Kish Khemani,* Supply Chain Management Review, *March 2007.*

Improved Commodity Management

Raw materials represent the largest cost component in the chemical industry, so improved commodity management can significantly increase profitability. A data-driven approach that is executed collaboratively among procurement, sales and business leaders will allow chemical companies to better understand commodity supply and demand, and use that knowledge to maximize profits. Companies that take on the challenge will be better prepared in a volatile and competitive industry.

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