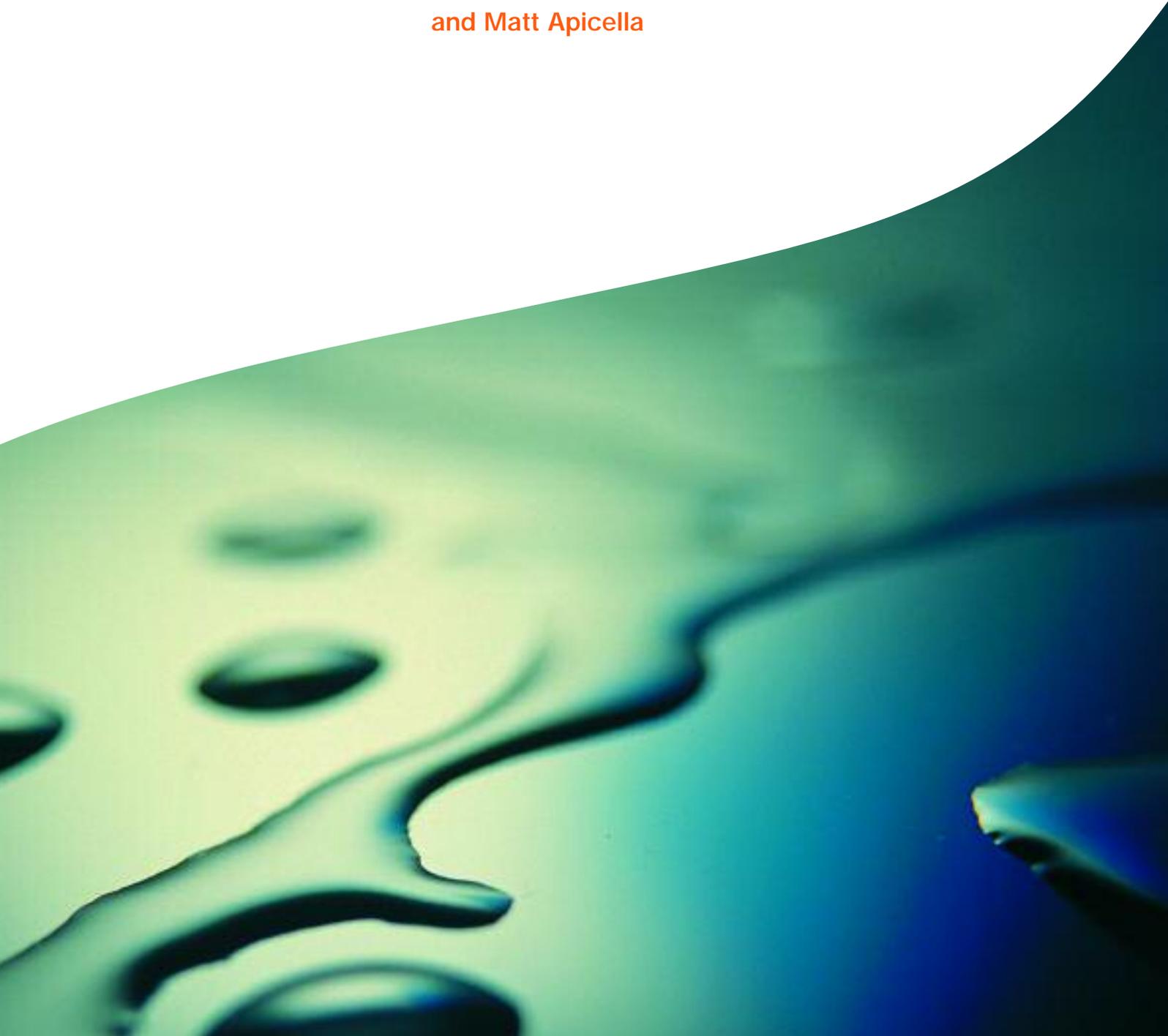


Creating the Integrated Value Chain for Downstream Oil

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Background

The increasingly complex, globally-extended downstream oil supply chain has received much recent attention as geopolitical unrest, weather-related disruptions, global competition, growing demand, constrained refining capacity, price volatility and industry consolidation continue to put pressure on energy markets. A few facts illustrate the situation over the past few years.

- Hurricane Katrina caused the shut-in of over 95% of offshore Gulf crude oil production, or almost 27% of total U.S. crude production. Several refineries were shutdown post-Katrina, resulting in a loss of over 28% of Gulf refining capacity and a loss of approximately 13% of total U.S. refining capacity. Gasoline prices rose 50 cents per gallon immediately following Hurricane Katrina, 20 cents per gallon after Hurricane Rita. (Source: Federal Trade Commission).
- Global demand for oil has grown steadily from 67.2 million to 85.4 million barrels per day since the first

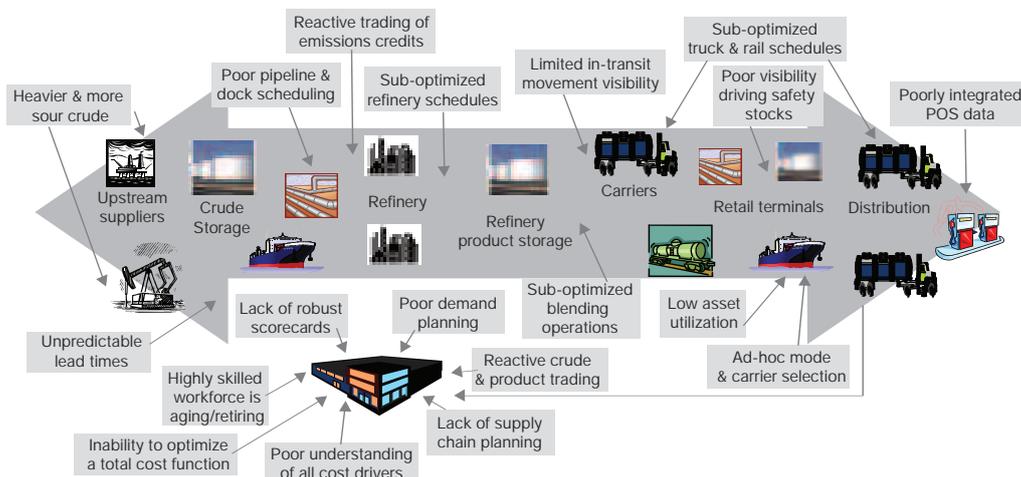
Gulf War, and is expected to grow to 118 million barrels per day by 2030.

- The prices for crude oil, refined petroleum, and natural gas are more volatile than prices for about 95% of products sold by domestic producers. (Source: Eva Regnier, "Oil and Energy Price Volatility").
- In the 1990s, several major oil companies merged to form "super majors" such as BP-Amoco/ARCO, Exxon-Mobil, Chevron-Exxon, and Conoco-Phillips.
- Market pressures have driven current prices beyond \$100 per barrel, with forecasts of higher prices yet to come.

With the downstream business maintaining focus on margins, the supply chain planners and schedulers are continuously scrutinized and expected to drive savings through improved forecasts and schedules while dealing with shorter planning horizons. Traditionally, however, planning and scheduling functions at the integrated oil companies have

been fragmented, or at best manually integrated through the sharing of spreadsheets and documents among multiple stakeholders through a series of decision steps. Moreover, many of the highly skilled and experienced supply chain professionals are part of an aging workforce and nearing retirement. These workers carry with them much of the knowledge and 'informal' process steps that have helped overcome the lack of current supply chain integration. This planning effort is further complicated as refineries have to process heavier and more sour crude slates with existing equipment. Blending plans and methods need to be sophisticated and integrated into the planning effort to ensure customer demands are met with the changing crude quality and composition. Downstream companies are reacting to the situation to protect their margins and remain competitive. Figure 1 shows some of the current issues faced along the supply chain in planning, scheduling and execution of oil movements.

Figure 1: Today's Supply Chain Challenges



Current Trends and Industry Emphasis

The recent implementations of planning and scheduling tools demonstrate an emphasis to leverage these capabilities to improve the demand forecasting and supply planning functions. The end goal of these initiatives should be to create an integrated and adaptive supply chain where planners and operators have end-to-end visibility that improves decision making, reduces supply chain costs, lowers inventories, better utilizes assets and improves margins. However, despite these initiatives, the two dimensions of business transformation are not fully addressed:

1. Business processes remain fragmented and
2. Technologies that can provide integration and enable the processes are not effectively implemented.

Companies are typically more interested in point solutions to address specific departmental issues because available tools were perceived to be easy to implement and bring quick results. However, these initiatives do not capture the full value of the tools when solutions were not extended and integrated throughout the entire supply chain.

Today's powerful scheduling and trading applications provide the potential, when properly implemented, for supply chain professionals to:

- Balance supply against demand,
- Convert their plans into optimized schedules using sophisticated optimization algorithms,
- Execute movements to meet demand with real-time monitoring and event management,
- Provide visibility into crude and product movements, inventories and spot or contract purchases,
- Enable schedulers to coordinate shipments with ship, pipeline and land-based carriers and, drive trades to ensure product availability,
- Provide “what-if” scenario planning capability to project the impact of changing market conditions and dynamically adapt to shifting customer demand.

On the execution side, event management tools combined with powerful planning engines and scheduling and inventory management tools can improve the ability to recognize and react to changes and adjust scheduled movements based on real-time data. Intelligent alerts are also being utilized to monitor and manage adherence to KPIs and key operating metrics that further facilitate communication and issue detection. Existing technologies provide all the required components and capabilities to realize the adaptive supply chain.



What is missing?

To date, however, efforts to implement these applications have followed a consecutive and fragmented approach. Firms tend to proceed with point solutions in a sequential manner focused on immediate needs. However, these initiatives may not be fully integrated to provide a holistic solution. This approach fails to identify a global cost optimal position since it does not minimize a cost function that incorporates the full set of constraints and considers all costs and trade-offs.

Another key issue impacting success is the limited emphasis on organizational changes and knowledge transfer to support new processes and technologies. With these new tools, supply chain planners need to be more in tune with schedulers, marketers, traders, logistics providers and others and collaborate more effectively. The process knowledge and experience captured from employees nearing retirement must be transferred to the next generation and must also be incorporated in technical solutions (i.e., the technology must be 'smart'). The traditional operating model (i.e., requiring no terminal run outs regardless of cost impacts),

inadequate change management and knowledge transfer efforts and the inability to understand and account for all the dynamic cost and operational drivers and trade-offs, has resulted in the continued use of predominantly manual planning processes by a highly skilled and aging workforce. Thus, supply chain managers are limited in their ability to run at optimal conditions and face significant risks as they lose existing knowledge due to retirement and employee turnover. In addition, unlike with financial metrics, dashboards and reporting processes for operational KPIs are not as robust and are unable to provide the visibility needed to improve decision making.

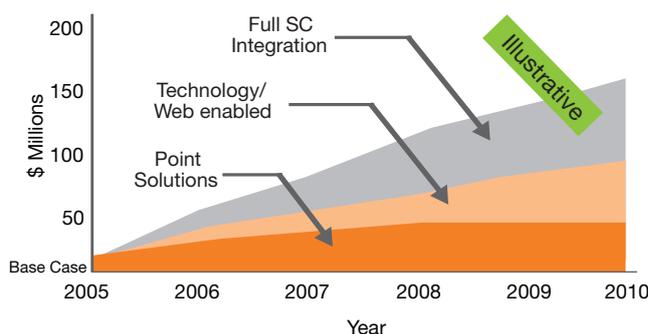
Looking beyond the business process and towards the technology, there exists a heterogeneous IT landscape with poor integration and coordination among legacy point solutions, home-grown tools, ERP infrastructures and best of breed applications. The industry consolidation has exacerbated this complexity of technology infrastructures across the globe as multiple, often incompatible instances of ERP packages and legacy systems

have to communicate and interlink within a new, larger organization.

Though similar situations exist in other sectors, these industries have been more aggressive than their energy counterparts in implementing demand and supply improvement programs towards the creation of an integrated supply chain which drives to greater supply chain profitability (see Figure 2). Capgemini's experience implementing such programs for major non-energy clients has yielded consistent tangible benefits of 10% increases in service levels, 20% reductions in inventory levels, over 50% decreases in finished goods inventory and \$400 million increase in working capital. In addition, the Aberdeen group has reported that implementing such programs across global industries, such as transportation and logistics, both air and ground, which focus primarily on services yielded higher gross operating margins of 5% and improved inventory turns by 25% and forecast accuracy by 13%. Benefits will vary, but the economic potential is significant as demonstrated by companies such as DHL or Federal Express. Within the downstream business, our experience implementing improved integrated demand planning solutions with a leading refining and marketing global major company yielded approximately \$16 million in annual savings and reduced their planning cycle by 33-50%.

With the current margin levels, now may be the best time for downstream oil companies to invest in an integrated value chain that can adapt to changing market conditions and drive higher profitability.

Figure 2: Supply Chain Economic Potential



What is Next — The Solution?

Our view is that the adaptive supply chain is the core process component of the value chain. The value provided by the customer is extracted along the supply chain by integrating and streamlining processes. Capgemini developed the **Downstream Integrated Value Chain Optimization (DIVCO)** framework as an industry specific strategy and solution methodology capable of integrating the entire Downstream Oil value chain into one holistically managed business entity. DIVCO provides a comprehensive business transformation solution by addressing the process and organizational change needs and the technology requirements to deliver optimal value. The proposed solution combines

1. Value chain process transformation creating integrated business processes for demand planning and management, trading and scheduling and demand-supply balancing,
2. Organizational change to create a cross-functional process-focused organization and
3. IT architectural transformation to an SOA platform where planning, scheduling and execution tools are integrated along the full scope of the supply chain.

Next generation applications combined with SOA provide the necessary technology infrastructure to realize the adaptive supply chain described by DIVCO. The DIVCO model consists of market and supply side factors and their environments, the adaptive supply chain and customer and supplier collaboration.

Designing the Integrated Processes for the Adaptive Supply Chain

To create the adaptive supply chain, it is critical to seamlessly couple crude and feedstock acquisition, production optimization and distribution to terminals and retail outlets. Crude and feedstock selection and trading should be based on inputs from plans and forecasts and notifications should be sent when situations change. This type of integrated process with feedback loops and communication should exist along the entire value chain. The more robust and closely linked the process steps are, the more adaptable the supply chain is to shifts in markets and customer demand, making the organization better able to avoid additional costs and delays. The added flexibility also allows the downstream business to more effectively capture new sales or margin improvement opportunities.

When redesigning processes, the one size fits all approach is risky and may not provide the optimal solution. In our experience, it is important to set global design standards, but the conceptual solution must provide enough flexibility for regional operations to customize the solution. However, global standards ensure that performance targets are met by delineating clear solution requirements and performance expectations. We call this our “hothouse” approach and it allows the regions to test and refine the global design through a series of iterations resulting in a local solution based on global requirements. Within the global lubricants division of a global major client, using this approach Capgemini

not only delivered improved processes, but also drove cultural change as the regional managers took ownership of global design refinement to create their local version. The client realized over \$400 million in cost savings within 2 years.

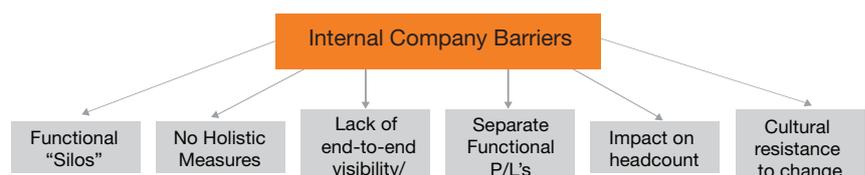
To further facilitate and expedite project execution and solution design, Capgemini's **Rapid Design and Visualization (RDV)**TM methodology can support the business transformation initiatives within DIVCO. RDV incorporates early visualization and interaction to drive user-friendly business solutions. It is an accelerated design approach that reduces risk while increasing innovation by delivering highly functional visualizations of a proposed solution or business process where the business, IT and users can provide immediate feedback to developers and process designers. The RDV approach has reduced rework costs by up to 70%, increased innovation in solution design by 3 to 4 times and accelerated time to market, on average, by 20%. Capgemini utilized the RDV methodology at a seminar to demonstrate complex ERP functionality using a life-like prototype that was developed in under a week. The demonstration would have taken months to develop in a live system, requiring extensive coding and costly rework.

Delivering Process Improvements with Cross-functional Teams

To support the integrated business processes, organizations need to shift their focus from a functional structure to a more matrixed, cross-functional organization. To address the internal barriers to change (see Figure 3), the change management efforts should focus not only on organizational design, but also address the skill development and culture change required to create a collaborative, cross-functional team and remove functional silos. Moreover, this effort will help build institutional knowledge of the process and reduce the risk of losing existing know-how when a few highly skilled and knowledgeable process experts decide to leave or retire. This shift to a process-focused organization will support the communication and integration required across the various functions to create the proper environment to sustain an adaptive supply chain.

Capgemini's hothousing approach described earlier is a methodology that helps carry the organization through the cultural and process changes and instill the correct behaviors and skills to create a sustainable process transformation. Further, the RDV approach allows input from multiple stakeholders early in the design phase creating a sense of involvement and ownership, thus increasing adoption and facilitating change.

Figure 3: Supply Chain Integration Hurdles



Enabling the Value Chain with Technology

The DIVCO model is enabled by an integrated suite of supply chain tools based on leading practices. To support the integration of the multiple tools and applications used in planning, scheduling and execution within the supply chain, the first technical consideration of DIVCO is the establishment of an SOA strategy and platform to transform the IT landscape. We can consider the various tools as services linked through a standard platform (see Figure 4) Some of the services to consider include:

- Planning service that provides demand and supply plans and incorporates market information. This service should also learn from historical data and continuously improve forecast accuracy and planning capabilities
- Inventory service will monitor crude,

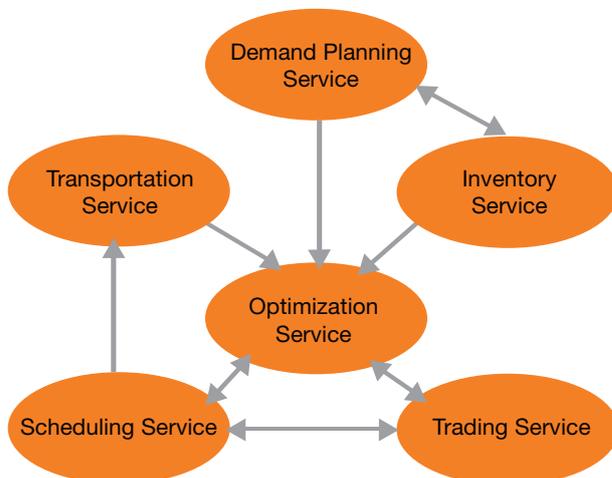
terminal and refinery inventory providing near-real time updates

- Transportation service will manage the host of service providers from rail, truck, pipeline and shipping ensuring that the providers have been qualified and meet all legal, environmental and operational requirements
- Scheduling service will review the availability of transport services and match service providers with demand locations
- Trading service will provide near real-time information on spot trades available and completed as well as existing contractual obligations
- Optimization service will be the engine that aggregates the various constraints and determines the optimal plan and schedule to meet a particular demand whether this is at the refinery level or within the distribution network.

Setting standards for interfaces will help facilitate the technical integration required to enable the adaptive supply chain. Another critical element is the data layer design and architecture. With multiple tools enabling the exchange of data in various formats, the design and development of the data layer is a critical success factor. Today's plants operate with real-time data provided through data historians, but the DIVCO model will need a holistic view that enterprise-level data historians can provide. The integration of planning, scheduling and execution processes will require extensive harmonization of data. Data within these processes is held at different levels of aggregation, may have incompatible coding schema and is typically generated and used at different times. Implementation of fully-harmonized data architecture is vital to the vision of an integrated supply chain.

As a recognized leader in technology and Service Oriented Enterprise (SOE), Capgemini has the requisite expertise and experience to design and deliver these complex technical solutions. We have also created a strong network of alliance partners who are shaping and directing the industry and technology standards together. We are working with our alliance partners- including SAP, Intel, HP, Cisco Systems, Microsoft, Sun Microsystems, Oracle, and IBM- as well as numerous other innovative niche software vendors to develop and implement SOE and SOA solutions.

Figure 4: Linkage of Services Through an SOA Platform

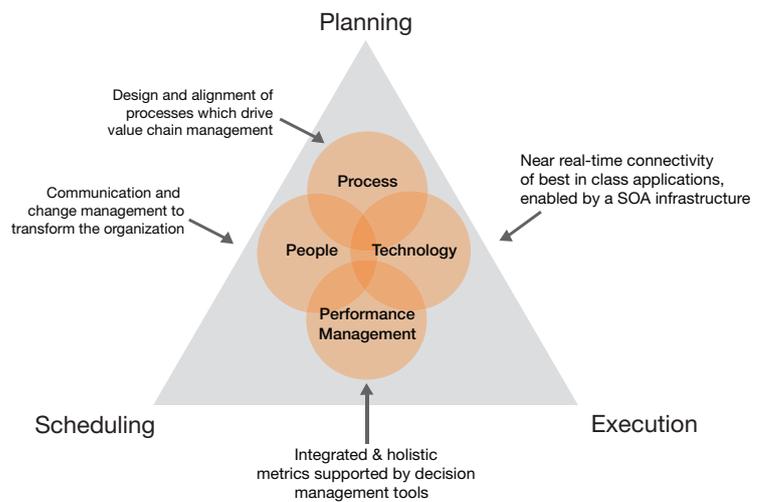


Ensuring Sustainable Results through Performance Management

While implementing an SOA strategy is a critical first step, firms must also improve their data management programs including data collection, cleansing, control checking to support performance measurement. To improve data collection, web-enabled data entry and access are required along the entire supply chain. With improved information flow, the operational dashboards and reporting will be more accurate and provide near real-time updates to performance changes. Then the dashboards become key decision support tools providing visibility to operators and planners. With robust data collection processes and continuous performance monitoring, management will have near real-time visibility to key metrics allowing them to maintain focus on value chain performance and ensure sustainable results from the DIVCO initiatives.

Our customized DIVCO solution will address business transformation through the process and people elements and address technology transformation through the IT architecture (see Figure 5). To monitor progress and improve visibility and communication, performance management tools and dashboards are implemented. Each of these elements is addressed within each business cycle: planning, scheduling and execution.

Figure 5: Customized DIVCO Solution



The combination of the business process transformation and the establishment of an SOA platform will address two dimensions of change: (1) integrated business processes supported by cross-functional teams; and (2) integrated tools along the entire value chain that enable the processes. Performance dashboards then help maintain focus and attention on the key issues to ensure sustainable benefits. When these elements are effectively addressed, people are involved and take ownership of the improvements and performance is continuously monitored, then companies will be able to successfully implement an adaptive supply chain accomplishing the vision of DIVCO.

How would DIVCO respond to a major supply disruption?

The DIVCO model is an integrated end-to-end value chain with near real time metrics to monitor performance. If a major crude supply disruption is encountered, normally operators would both manage the supply side by drawing from inventory and through contingency planning utilize secondary/alternative supply sources. Additionally capacity and demand planning programs could rapidly be implemented to ensure appropriate product meets customer fulfillment needs. The advantage of a DIVCO model is the visibility that it provides across the supply chain to manage the risk of a run out even under a severe supply disruption where even safety stock levels are impacted. With near real-time monitoring of inventory levels, inbound supply and Point of Sale demand, supply chain managers will be better equipped to deal with such scenarios.

What is the Value that DIVCO Delivers?

Downstream energy companies that implement the DIVCO model will realize significant benefits. These include cost savings, increased profitability, improved productivity and efficiency, improved emissions management, near real-time data and improved decision making. With end-to-end visibility, planners and schedulers will be able to improve the accuracy of their forecasts and reduce reactionary spot purchases. With more accurate demand and supply plans, companies will be able to better manage emissions and proactively trade emissions credits. In turn, inventories can be managed at lower levels while still improving fill rates and avoiding stock-outs.

What could be the magnitude of benefit that is derived from this integrated solution? Our experience and industry experts estimate the potential profitability increases to be in the range of \$2.00 to \$4.00/Bbl based on \$100/Bbl crude costs. These figures are based on:

- Cost reductions from increased efficiencies, forecast accuracy, reduction of overhead, improved emission management and reduced inventory,
- Revenue growth from enhanced offerings to customers, increased speed and responsiveness to market changes.

The business case for a DIVCO solution is based upon cost reduction and growth. Our experience indicates that the benefit to end-to-end integration would be broadly based and addresses the following areas:

- Revenue Enhancement/Cost Reduction

- Competitive Position,
- Risk Reduction,
- Market Value Considerations.

Figure 6 identifies some of the specific benefits within each of these areas. It should be noted that some of these benefits will be realized from improved execution and a deep understanding of the operational cost drivers, other benefits result from improved ability to handle capital market fluctuations and better deal capture while still other benefits are realized from improved scalability.

A typical business case would yield the following tangible benefits/opportunities: supply chain visibility \$0.35/Bbl forecast and scheduling effectiveness \$0.35/Bbl and feedstock flexibility \$0.20/Bbl.

Potential increases in profitability from a DIVCO solution will provide companies a significant competitive advantage in the marketplace. Downstream companies will benefit by building out their SOA infrastructure, but benefits will vary depending upon the maturity of the industry and the technology. The cost to achieve these benefits will also vary with the complexity and geographical constraints of the business. Our experience based upon completed work with downstream oil clients indicates that hardware, software, networking, and integration costs required to implement the DIVCO solution will be lower than the first 12-18 month benefits achieved. The benefit to cost ratio after this period would be greater than a 1 to 1, with growth projections improving as the program expands and matures.

Figure 6: Benefits - Quantitative and Qualitative

Revenue Enhancement/ Cost Reduction	Risk Reduction
<ul style="list-style-type: none"> - Reduced logistics & distribution costs - Decreased inventories / holding costs - Improved margins - Reduced working capital - Better asset utilization - 100% product availability at retail sites - More efficient buying / selling 	<ul style="list-style-type: none"> - Leverage proven technical and supply chain leading practices - Increased ability to manage price exposure - Defined roles & responsibilities - Increased teamwork and communications - Improved emissions management - Mobilized organization - Increased accountability - Supply chain visibility
Market Value Considerations	Competitive Position
<ul style="list-style-type: none"> - Increased accuracy/access to performance information - Improved decision making - Increased speed to market - Increased ability to react to market volatility - Creates platform for future revenue growth 	<ul style="list-style-type: none"> - Near real-time monitoring - Real-Time “what-if” scenario capability - Integrated feedstock demand/supply planning - Increased responsiveness to internal & external customers - Improved ability to assess & analyze competitor moves

Downstream companies must capitalize on current conditions and invest in process improvements and SOA to fully capture the benefits of their existing infrastructure. Moreover, to remain competitive these companies must aggressively attack opportunities within the supply chain to drive value and become more flexible against volatile markets, shifting geopolitical trends and disruptive weather conditions. Capgemini’s DIVCO framework, our deep industry expertise and extensive experience in supply chain, business transformation and SOA will drive transformation of downstream operations into the adaptive and integrated value chain required to remain competitive and drive future growth.



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Capgemini, one of the world's foremost providers of Consulting, Technology and Outsourcing services, has a unique way of working with its clients, called the Collaborative Business Experience.

The Collaborative Business Experience is designed to help our clients achieve better, faster, more sustainable results through seamless access to our network of world-leading technology partners and collaboration-focused methods and tools. Through commitment to mutual success and the achievement of tangible value, we help businesses implement growth strategies, leverage technology, and thrive through the power of collaboration.

Capgemini employs over 80,000 people worldwide and reported 2007 global revenues of 8.7 billion euros.

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More information about our services, offices and research is available at www.capgemini.com/energy

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