Supply Chain Integration: Challenges and Good Practices

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Executive Summary

The last decade has brought a dramatic shift in the nature of competition for most companies. Technological advances, particularly in information technology, coupled with globalization, the rise of complexity and shrinking time horizons are driving order-of-magnitude changes in the competitive demands on strategic management of business and on the management of supply chains.

These competitive pressures have a strong direct effect on supply chain strategy and integration. Integrating activities both within and beyond organizational boundaries has become and will continue to be a major challenge for supply chain executives. Integration efforts now extend beyond traditional product-process design and functional integration to focus on extra-organizational links with customers and suppliers. The object is to produce “supply chain-enhanced” products and services.

Our examination of supply chain integration focuses on two key issues — alignment and linkage — both inside an organization and across organizations.

- **Alignment** refers to common vision, goals, purpose and objectives across organizations, functions and processes in the supply chain. Alignment ensures that there is consistency in the direction and objectives as these plans and decisions are made.

- **Linkage** refers to the communication and sharing of information needed for planning and decision-making, and the interaction of people involved in planning and decision-making. Linkage ensures that the information necessary for decision-making is available, and that different functions and entities in the supply chain are working with the same data as decisions are made.

Supply chain alignment and linkage do not happen in a vacuum. Supply chain management is a part of the broader management of an enterprise, and it must support the broader business strategy of the enterprise.

**Business Strategy** defines how the firm intends to compete in the markets or market segments it pursues. Broadly speaking, a firm can compete on low cost or through differentiation. Supply chains can contribute significantly to both sets of goals. However, different business strategies are likely to be best supported by different supply chains and supply chain management decisions. A business strategy based on speed of innovation and fast time to market would require a different network of suppliers, a different manufacturing infrastructure and a different distribution infrastructure than a strategy based on low costs. It is therefore critical that the strategies pursued and the decisions made by the supply chain group be consistent and aligned with the overall strategy of the enterprise.

**Supply Chain Strategy Planning Decisions** relate to coordinating supply chain management decisions with business strategy, product/service design decisions and with designing the physical supply chain. The right infrastructure, in terms of technology, people, control systems, relationships, policies and procedures are critical in facilitating alignment and linkage.

Our research identified four critical supply chain strategy areas:

- **Supply Chain Strategy and Vision**
  Supply Chain Strategy and Vision defines the role supply chain management will have in the organization and in the pursuit of the business strategy.
Insourcing/Outsourcing Strategy
Insourcing/Outsourcing Strategy goes to the heart of the firm’s value proposition — what is it that the firm does better than anyone else — to create value for the customer. What is kept and what is outsourced depends on supply chain strategy and drives supply chain strategy.

Supply Chain Segmentation and Architecture
Supply Chain Segmentation and Architecture addresses the design of the supply chain, its physical structure, its information flows, its cash flows and its “conceptual” structure. Supply chain segmentation broadens the familiar concept of market segmentation to the consideration of differential supply chains (manufacturing plants, distribution centers, supply bases) to support the different market segments.

Product and Service Design
Product and Service Design must include supply chain considerations in product/service design decisions. Product designs largely influence manufacturing efficiencies, distribution system requirements and customer service levels. By including supply chain perspectives, product and service designs can be more effective.

Supply Chain Execution Processes incorporate the operational decisions in supply chain management that must then be aligned with the supply chain strategy. The design and execution of these processes determine in large part how supply chains perform. The processes define how the firm matches supply with demand to deliver value to the customer. Included here are the processes for forecasting and demand management, order promising, operations planning, material planning and supply management. The key issue across these processes is linkage — facilitating the communication and information sharing necessary for making decisions that are consistent and focused on meeting customer expectations. The three key supply chain processes identified in this research are:

- Supply-facing Processes for Order Fulfillment
- Sales and Operations Planning (SOP)
- Customer-facing Processes for Order Fulfillment

Supply Chain Enablers are the final key to the puzzle. These enablers do not by themselves make alignment and linkage happen, but if they are not in place, alignment and linkage will suffer. The enablers identified by the research are:

Communications and E-systems
Communications and e-systems comprise both the technology available for collecting and sharing data and information, and the mechanisms in place to facilitate people-to-people communication in support of decision-making. The systems help ensure data availability, accuracy and timeliness. Equally important, however, are the processes and procedures that encourage and facilitate the use of that data for effective decision-making.

Trust
Trust is at the heart of breaking down the functional and organizational barriers that impede true integration. Without trust and the willingness to collaborate, it is impossible to achieve aligned, consistent decision-making and actions required for the integrated supply chain.

Organization and People
Organizational structures include reporting structures, team membership, and roles and responsibilities and, as such, largely shape the ways people will interact and relate to each other in an enterprise. The wrong organizational structure can exclude key stakeholders and key resources from important decisions and inhibit the collaboration needed to achieve alignment and linkage. Working within the organization structure, the skills and capabilities of people are critical to successfully integrating a supply chain.

Metrics
Metrics and reward systems are critical factors in driving behavior within an organization and among organizations. Regardless of the “strategies” or “philosophies” around supply chain integration that are voiced by top management, it is the metrics and rewards to which people respond. Customer-centric metrics that are aligned and consistent across different functional groups and across organizations in the supply chain will encourage behavior that leads to aligned and consistent decisions.

Challenges to Supply Chain Integration
Based on the case studies completed as part of this project, we conclude that well integrated supply chains are not ubiquitous at this time. There are certainly many success stories and many pockets of excellent supply chain integration. There are also many cases of failures and breakdowns in integration. Through our research, we have identified 14 key challenges organizations must meet to achieve true supply chain integration.
1. Establish a vision of how financial and non-financial results will improve with supply chain integration.

2. Develop people, culture and an organization that supports the supply chain vision.

3. Develop customer-centric metrics.

4. Develop multiple supply chains to meet the needs of different customer and market segments.

5. Establish the correct positioning of work on a global basis.

6. Incorporate supply chain consideration into product and service design decisions.

7. Maintain sourcing as a first-level priority.

8. Stay focused and consistent in relationships with customers and suppliers.

9. Create an effective Sales and Operations process.

10. Develop valid and reliable databases, data and information.

11. Develop the capabilities and analytic tools required to make effective decisions in an increasingly complex and risky environment.

12. Build trust within and across organizations in the supply chain.

13. Find ways to share risk equitably among supply chain partners.

14. Find ways to share rewards equitably among supply chain partners.

This research does not provide all of the answers to overcoming these challenges to integrating your supply chains or even a comprehensive approach for doing so. But in the following pages, you will find strategies and good practices developed by our focus companies to meet these challenges and to push ahead in integrating supply chains.
Chapter 1: Supply Chain Integration: The Competitive Challenge

Introduction

The last decade has brought a “dramatic and far-reaching shift” in the nature of competition in most industries, resulting in a new competitive paradigm called “hypercompetition.” Following is an explanation:

Strong forces of change — globalization, demographic shifts (e.g. aging population and declining fertility rates), advances in information technology, demassification of society and hypercompetition — are reshaping the competitive landscape worldwide. As a result, companies in most industries are not only undergoing rapid and radical change, but are also experiencing a fundamental shift in the rules of competition and the way the game of competition is played. The old, genteel, stable oligopolies that defined competition during the 20th century are rapidly restructuring. In their place are emerging markets fraught with uncertainty, diverse global players, rapid technological change, widespread price wars and seemingly endless reorganization. That transition is occurring not only in the United States, but also in Europe, Latin America, and Asia.¹

Over the past decade, global competition has relentlessly increased within and across industries. This, coupled with the rapid change in oil and commodity prices, currency exchange fluctuations, technological advances (particularly in information technology), rising labor costs in low-cost regions and political uncertainties requires enhanced leadership, management and integration of a company’s supply chains.

The emerging consensus among researchers and practitioners is that these factors are driving the need for systemic order-of-magnitude changes in the strategic management of the supply chain, including enhanced integration. This research was undertaken to help companies achieve meaningful supply chain integration.

Research Objectives and Focus

The overall objectives of this research were to:

1. Determine how supply chain integration is being achieved internally and cross-enterprise.
2. Identify challenges that are encountered and how they are being overcome.
3. Determine the potential benefits resulting from enhanced integration of supply chains.

Supply Chain Integration Defined

For purposes of this research, supply chain integration is broadly defined as the alignment of supply chain goals and objectives between functions and enterprises, and the linkage of these functions and enterprises through information transparency, electronic or people-to-people.

Research Approach

Field research was conducted at 12 companies in five industry sectors, including appliance, consumer products, engineering construction, hospitality and semiconductor. The companies included five focus companies, two customers and five suppliers. Multiple

interviews were conducted at each company in customer- or supply-facing activities, such as purchasing, requirements planning, logistics, product development, marketing, and sales and operations planning. Two or three researchers were present at each interview that typically ranged from one to two hours over one- and two-day visits.

Interviews focused on the supply chain touch points between functions and between enterprises. The goal was to gain insights into how alignment and linkage were achieved at these touch points. Chapter 2 discusses the research model in detail. During and after data collection, interview notes were formalized, organized into major categories, analyzed and interpreted to provide the basis for this report.

The remainder of this chapter discusses selected competitive factors that influence supply chain competition, examines their implications for supply chain integration and outlines the content in the following chapters.

**Competitive Factors Influencing Supply Chain Competition**

**The Quest for Competitive Advantage**

The idea of sustainable competitive advantage requires that superior economic performance compared to competition be achieved over time. It is based on unique capabilities valued by the market and is difficult to duplicate in a particular industry space. However, it appears that sustainable competitive advantage is difficult to achieve and maintain over time as measured by superior economic performance.

Two studies done by Wiggins and Raefli, 2002 and 2005 (from a sample of 6,772 firms in 40 industries over 25 years) found that:

- Only a small minority of firms exhibit superior performance for a 10-year period.
- Regulating mechanisms in the market constantly pressure superior performing firms to return to the main group, while sub-performing firms either improve efficiencies or continue in a downward spiral of decline and eventual failure.

In the follow-up study by the same researchers in 2005, additional evidence was provided that competitive advantage is getting harder to attain, harder to sustain and is shorter in duration. Also, competitive advantage is becoming less a matter of a developing and maintaining a single advantage over time but more a matter of “concatenating over time a sequence of advantages” (Wiggins and Ruefli 2005).³

The overall implication is a paradigm shift for the strategic management of the supply chain in which the key challenge to attaining and sustaining competitive advantage becomes how to continuously improve internal flexibility and reduce competitive response time. In addition, the continuous implementation and improvement of multiple versus single strategies providing for competitive advantage and agility across all elements of the supply chain will be a likely requirement.

Examples of the rapid change that supply chains of the firms studied have had to respond include:

- Faster than anticipated market shifts to new products and technologies
- Erosion of dominant worldwide market positions
- Increasing supply constraints and upward pricing pressure from suppliers
- Increasing size and complexity of projects
- Remote and complex project locations worldwide
- Fewer available suppliers and customer requirements for cycle-time reduction
- Rapidly changing customer mix with pressure for reduced response times
- Significant price/cost squeeze with less available market share
- “Flawless execution” required for new product and service introductions
- Product design cost reductions with product innovations
- Significant emphasis on “lean” and “agile”

**Time Compression**

The idea of time-based competition is not new. The ever-accelerating pace of competition, however, continues unabated. Senior executives in the current study testify to a significant compression of time within just last two to three years. Transitions of all kinds — markets, products, processes, technologies — are quickening and increasingly overlapping, adding to the complexity of managing a global supply chain.

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To compete effectively, supply chains will have to be increasingly agile to meet changing customer and competitive demands. In addition, firms will have to quickly respond to labor rate, fuel and energy cost, and political uncertainties. These dynamic changes will require rapid shifts in manufacturing sites, distribution centers and outsourcing locations for both manufacturing and business processes, and the agile reconfiguration of supply chains.

Information Technology
Another major catalyst of change and source of competitive advantage in supply chain management is information technology. It is transforming the way firms communicate with, transact with and learn from customers, competitors and supply partners, and therefore compete across the supply chain. Information technology enables firms to exchange information with a broader set of partners, leading to positions of greater certainty across more relationships. Consequently, the strategic role of effectively and efficiently managing supply chains has steadily expanded across enterprises and extended across geographies.

Overall, firms are now confronted with more complex environments. These complex environments are characterized by rapid and/or discontinuous change in demand and resource availability, or technology shifts, which lead to contingencies difficult or impossible to anticipate. As firms increase the scope and distance of their activities, and work to include more constituents in their decision process, they introduce additional management complexity. Therefore, valid and timely information across all elements of tightly coupled supply chains is required to provide for the appropriate allocation of human, physical, financial and information resources across these extended and complex supply chains operating in changing environments.

Implications for Supply Chain Integration

The emerging competitive pressures listed above, coupled with the need for sustainable competitive advantage, have a strong ripple effect on supply chain strategy and supply chain integration. Specific implications drawn from the project include:

1. **Margin squeeze is increasing the pressure to improve overall supply chain effectiveness and efficiency, and to reduce costs worldwide.**

Companies in all participating industries report increased downward pressure on prices, combined with an increased upward pressure on costs. Price pressure is uniformly attributed to increased competition from traditional competitors as well as new global competitors. Cost pressure is typically attributed to shortages of raw materials, for example, steel in the engineering/construction industry, substrates in the high-technology industry and oil-based products across multiple industries.

Some of the shortages are systemic and are likely to continue for the foreseeable future. For example, the rising price of oil is having a ripple effect that extends even to consumer products companies. One consumer products executive indicated that for every $10 per barrel increase in the price of oil, the company loses 1 percentage point of margin as a result of increased transportation costs. When margins in many industries and markets are already “razor thin,” it can mean the difference between profit and loss.

2. **Search for growth is increasing the focus on deriving innovation and market opportunity from the supply chain.**

The supply chain has long been recognized as a source of “value-add” service, especially in the areas of fulfillment, delivery and support. While these traditional competencies remain important, companies are increasingly looking to the supply chain to provide early identification of emerging trends and markets, and early access to new technologies, processes and products.

Suppliers with their unique areas of technical expertise and diverse interactions in different markets across their customer base are often better positioned to spot leading trends and develop or leverage emerging technologies. This in itself is not a new phenomenon. However, what is new is the increasing reliance of buying firms on the supply chain as a source of “top-line” growth. Increasingly, companies are sourcing, outsourcing and offshoring for revenue impact and not just for cost.

3. **Globalization is causing supply chains to simultaneously fragment and expand, driving unprecedented complexity throughout all aspects of a company’s operations and the supply chain.**

Globalization is making supply chains longer and more complex, adding uncertainty and risk. Complex supply chain processes, like new product/process/technology transitions, sales and operations planning, etc., are accomplished across geographies and locations. The complex processes require greater information sharing and collaboration across multiple time zones and “cultures.” Furthermore, many of these supply chain processes are increasingly restructured with suppliers...
and/or third-party contractors assuming responsibility for activities previously performed “in-house.” The reconfiguration of who does what in the supply chain, especially the outsourcing and offshoring of so much manufacturing and services, decreases a single firm’s ability to control the entire process and increases all firms’ dependency on effective collaboration and integration. As dependency on third-party contractors increases, management influence on critical decisions decreases, and more supply network interdependency adds complexity with slow decision-making.

The extended supply chain also can mean that transportation and logistics lead times are longer than production lead times, resulting in additional planning and execution factors and uncertainties. With more partners and longer lead times in supply chain processes, the timeliness, quality and reliability of data is increasingly at risk.

In addition, increasing product proliferation with increasing options and changeovers to new products at different times strains supply chains. Additional forces of strain include changing demand patterns worldwide, such as growth in the Asia-Pacific region; increasingly complex supply planning because of the number of manufacturing or operating locations sourcing from multiple worldwide locations; and, overwhelming amounts of data, much of which is redundant or limited in accuracy.

4. **Companies are experiencing increased demand volatility while customer and competitive dynamics require increasing and often “real-time” responsiveness.**

External research confirms that companies are facing increasing demand variability. A Forrester Research study found that the number of online consumers who want to buy customer products that are engineered-, made-, or configured-to-order has risen 65 percent in recent years. Consequently, at many companies the number of products and variations of products have proliferated, increasing the number of SKUs that must be forecasted and planned in the sales and operations planning process. Consumer products companies, for example, introduce on average more than 80 new products every year.

At the same time, however, companies are struggling to forecast demand for this increasing array of products. Nearly all companies base their supply chain planning and execution on demand forecasts and yet only a minority considers those forecasts to be reliable. Thus, the execution of an integrated supply chain is confronted by a difficult dilemma — effective planning requires reliable forecasts, but increasing demand volatility and product proliferation is making forecasting increasingly inaccurate and unreliable.

5. **The risks associated with poor decision-making have increased, particularly in the area of aligning supply and demand, and linking that to profitability.**

When companies “call” the wrong product mix, target the wrong customers, channels, geographies, or miss the timing on a market/product transition, it can negatively impact the results for the quarter or the year. It also can cripple the profitability of a product or program. Similarly, on the supply side, when companies incorrectly develop capacity and material plans or product, process and technology transitions, profits may evaporate. In addition, the inability to integrate the supply chain in a way that enables synchronization of demand and supply throughout the supply chain can have unfortunate consequences. Having too much inventory or having the wrong inventory at the wrong place and the wrong time can have a disastrous impact on a company’s profitability. Excess inventory is quickly discounted; unsatisfied customer demand is lost sales and revenue; and to miss a market, product, process or technology transition risks being put out of business.

**Conclusions**

Integrating activities both within and beyond organizational boundaries is and will continue to be a major challenge for supply chain executives. Integration efforts now extend beyond traditional product-process design and functional integration to focus on extra-organizational links with customers and suppliers. The object is to produce not just a “service-enhanced product” as in the traditional supply and operations strategy paradigm, but a “supply chain-enhanced product and service.”

The integrative challenge has become far more complex. Consequently, the interactive dynamics between strategy integration and the role of supply chain executives remain one of the most challenging in management. The results of this research are meant to provide more insights into overcoming supply chain integration challenges and contributing to sustainable competitive advantage.
Report Organization

The following chapters provide insights into the key elements that impact a firm’s ability to achieve supply chain integration:

Chapter Two — Discusses the overarching supply chain integration model guiding the research, and identifies critical supply chain challenges

Chapter Three — Provides information around four critical supply chain strategies, namely,

- Strategic vision for the supply chain
- Insourcing/outsourcing strategy
- Supply chain segmentation and architecture
- Product and service design

Chapter Four — Provides information about supply- and demand-facing processes, and sales and operations planning

Chapter Five — Focuses on the impact of enablers on supply chain strategies and processes. Enablers include communications and e-systems, organizations and people, metrics and trust

Chapter Six — Provides detailed information about the challenges to supply chain integration and good practice examples to overcome the challenges

Chapter Seven — Focuses on the roles that supply management plays in supply chain integration

Chapter Eight — Provides conclusions

Appendices A and B provide additional background information about the industries in which the participating firms in the study compete, and the research methodology.
Chapter 2: Overall Model and Supply Chain Challenges

Introduction

This chapter describes the overall model of supply chain integration that guided this study. The critical concepts of “alignment” and “linkage” in the supply chain are discussed first, followed by brief descriptions of the key strategies, processes and enablers that support supply chain integration. The chapter concludes with a discussion of “Top Supply Chain Integration Challenges” — the most critical issues facing organizations attempting to improve integration in their supply chains.

Alignment and Linkage

Our examination of supply chain integration focuses on two key issues — alignment and linkage — both inside an organization and across organizations. Our working definitions of these terms are:

- Alignment refers to common vision, goals, purpose and objectives across organizations, functions and processes in the supply chain.
- Linkage refers to the communication and sharing of information needed for planning and decision-making, and the interaction of people involved in planning and decision-making.

Alignment ensures that there is consistency in the direction and objectives as supply chain plans and decisions are being made. Linkage ensures that the information necessary for decision-making is available, and that different functions and entities in the supply chain are working with the same data as they make decisions. Moreover, linkage implies communication and interaction among different individuals, functions and organizations in the supply chain, which will support the coordination of planning and decision-making.

Integrated Supply Chain Triad

To understand supply chain integration, it is not sufficient to consider only the interrelationships of a firm with its supplier or of a firm with its customers. We believe it is necessary to think in terms of “triads” of firms comprising a portion of the supply chain involved in producing and delivering a product or service (see Figure 1). We are interested in the physical/material flows, financial flows, and information/communication flows both across the triad and within the firms that make up the triad.

A supply chain triad comprises a “focus” company, along with one of that company’s tier-1 suppliers and one tier-1 customer. Looking at this three-firm segment of a supply chain allows us to consider whether the nature or the degree of integration that exists differs on the customer-facing versus the supplier-facing sides of the focus firm. We can also consider whether there are differences in the strategies and practices used to achieve greater integration with customers versus suppliers. Finally, this approach offers the opportunity to evaluate whether there is truly integration occurring across the supply chain, or just between pairs of firms in the triad.

External and Internal Alignment and Linkage

Externally, the objective is a supply chain composed of firms with a common focus on maximizing value for the ultimate customer. This envisions a common, or at least consistent, set of goals across the organizations. Operationally, extensive communication and information sharing up and down the supply chain are needed to support consistent and mutually supportive decisions by the individual firms making up the supply chain (see Figure 2).
Figure 1
Integrated Supply Chain Triad

Figure 2
Alignment and Linkage — External

Align goals, purposes, and objectives. Communicate & share key information to support decision-making.
No less important is *internal* alignment and linkage across the various functions and decisions that must be made within each firm. Supply chain management is a part of the broader management of an enterprise. As such, supply chain management must support the broader business strategy of the enterprise (see Figure 3).

The business strategy defines how the firm intends to compete in the markets or market segments it pursues. Broadly speaking, a firm can compete on low cost or through differentiation. Differentiation can mean attracting customers on the basis of superior quality, delivery, responsiveness, features and functionality, speed, and so on.

Different business strategies are likely to be best supported by different supply chains and supply chain management decisions. For example, a business strategy based on speed of innovation and fast time to market versus a strategy based on low cost would likely call for a different network of suppliers, different roles for those suppliers, a different manufacturing infrastructure, a different distribution infrastructure, as well as different performance metrics across the supply chain. It is therefore critical that the strategies pursued and the decisions made by the supply chain group be consistent and aligned with the overall strategy of the enterprise.

Supply Chain Strategy comprises those supply chain decisions that relate most directly to the overall strategy of the enterprise. The decisions in this area address how supply chain management will fit into and support the overall business strategy. These decisions relate largely to designing the supply chain and coordinating supply chain management decisions with product/service design decisions.

The operational decisions in supply chain management — planning and execution — must then be aligned with the supply chain strategy. These day-to-day decisions determine, to a large extent, how the supply chain performs, so they must be made with an eye toward achieving the goals defined by the business strategy and the supply chain strategy.

Finally, the right infrastructure, in terms of technology, people, control systems, relationships, policies and procedures are critical in facilitating alignment and linkage. These “enablers” do not, by themselves, make alignment and linkage happen, but if the proper infrastructure is not in place, alignment and linkage can be dramatically more difficult to achieve.

Our model proposes four critical supply chain “strategy” decision areas, three critical supply chain “execution” processes, and four important “enablers” that support the strategic and execution processes.

### Supply Chain Strategy Elements

Supply Chain Strategy addresses how supply chain management will support the Business Strategy (see Figure 4). The elements of Supply Chain Strategy include:

![Figure 3: Alignment and Linkage — Internal](image)
Supply Chain Strategy and Vision
Supply Chain Strategy and Vision defines the role supply chain management will have in the organization and in the pursuit of the business strategy. Some organizations have recognized the potential impact of supply chain management on competitiveness and have made the supply chain a key part of the overall business strategy. Without this executive-level awareness and attention to the supply chain, effective integration is not likely to happen.

Insourcing/Outsourcing Strategy
This strategy addresses where work will be performed in the supply chain — which activities and processes will be performed by the focal firm, and which will be performed by others in the supply chain. More than just a “make-or-buy” decision, insourcing/outsourcing strategy goes to the heart of the firm’s value proposition — what is it that the firm does better than anyone else — to create value for the customer.

Supply Chain Segmentation and Architecture
This addresses the “design” of the supply chain — both the physical structure of the supply chain and the “conceptual” structure. Supply chain segmentation broadens the familiar concept of market segmentation to consider that not only should the firm offer differential channels, service levels and relationship types for different market segments, but also whether the upstream supply network might also be segmented. Supply network segmentation could help align the upstream portion of the supply chain to provide the best support for key market segments.

Product and Service Design
Product and Service Design is a critical activity in nearly every enterprise. The key issue in terms of supply chain integration is whether supply chain considerations are a part of product and service design decisions. Many firms have recognized the value of a cross-functional approach to product and service design — in reflecting the knowledge and the perspectives of different stakeholders in these decisions. The supply chain perspective, and the knowledge and expertise supply chain professionals can bring to the table, can result in far more effective product and service design.

Supply Chain Execution Processes
The key supply chain execution processes include (see Figure 5):
- Supply-facing Processes for Order Fulfillment
- Sales and Operations Planning
- Customer-facing Processes for Order Fulfillment

This set of three execution processes essentially defines how the firm matches supply with demand to deliver value to the customer. Included here are the processes for forecasting and demand management, order promising, operations planning, material planning and supply management. The key issue across these...
processes is linkage — facilitating the communication and information sharing necessary for making decisions that are consistent and focused on meeting customer expectations. It the data used in making decisions in these three areas are inconsistent, inaccurate, incomplete or out of date, there is a huge likelihood that suboptimal, or even conflicting decisions, will result.

Key Enablers

The final part of the model is key enablers. The key enablers are part of the infrastructure environment and context of the enterprises in which integration is attempted (see Figure 6). They include:

- Communication and E-systems
- Organization Structure and People
- Metrics
- Trust

Communications and E-Systems

Communications and e-systems comprise both the technology available for collecting and sharing data and information, and the mechanisms in place to facilitate people-to-people communication in support of decision-making. If effectively designed and deployed, these systems will help ensure data availability, accuracy and timeliness. Equally important, however, are the processes and procedures that encourage and facilitate the use of that data for effective decision-making.

Organization Structure and People

Organizational structures define the ways people will interact and relate to each other in an enterprise — reporting structures, team membership, and roles and responsibilities. The wrong organizational structure can exclude key stakeholders and key resources from important decisions. It also can make it very difficult for people to work collaboratively to achieve alignment and linkage. In addition, the capabilities of the people themselves are key. Working and making decisions in an integrated way demand skills and capabilities that need to be further developed in many of today's supply chain professionals.

Metrics

Metrics and reward systems are critical factors in driving behavior within an organization and among organizations. Regardless of the “strategies” or “philosophies” around supply chain integration that are voiced by top management, those responsible for making integration happen will respond most directly to the metrics and associated rewards that are in place. Metrics that are aligned and consistent across different functional groups and across organizations in the supply chain will encourage behavior that leads to integrated supply chains.

Trust

Trust is at the heart of breaking down the functional and organizational barriers that impede true integration. Without a huge level of trust, collaborate to achieve aligned, consistent decision-making and integrated supply chains is extremely difficult, if not impossible.

Top Supply Chain Integration Challenges

Based on the case studies completed as part of this project, we conclude that truly integrated supply chains are far from a reality. There are certainly many success stories and many pockets of excellence where at least portions of some supply chains are being effectively integrated. However, there are also many stories of failures and breakdowns in integration — due to a
 variety of causes. Through our research, we have identified 14 key challenges organizations face in attempting to achieve true supply chain integration. Those challenges are:

1. Establish a vision of how financial and non-financial results will improve with supply chain integration.
2. Develop people, culture and an organization that supports the supply chain vision.
3. Develop customer-centric metrics.
4. Develop multiple supply chains to meet various customer segment needs for company products or services.
5. Establish the correct positioning of work worldwide through effective insourcing/outsourcing.
6. Incorporate supply chain ramifications into product and service design decisions.
7. Maintain sourcing as a first-level priority.
8. Stay focused and consistent in relationships with customers and suppliers.
10. Develop effective databases, data and information.
11. Develop the capabilities and analytic tools required to make effective decisions in an increasingly complex and risky environment.
12. Build trust within and across organizations in the supply chain.
13. Find ways to share risk equitably among supply chain members.
14. Find ways to share rewards equitably among supply chain members.

In the chapters that follow, we will discuss these challenges in more detail and the practices that the firms in our research are using to overcome the challenges. To preserve the anonymity of the firms, their customers and their suppliers, references to the focus firm in the triads are coded as follows:

- “ACO” is the focus firm in our household appliance industry triad.
- “CCO” is the focus firm in our consumer packaged goods industry triad.
- “ECO” is the focus firm in our engineering and construction industry triad.
- “LCO” is the focus firm in our lodging industry triad.
- “SCO” is the focus firm in our semiconductor industry triad.
Conclusions

Effective supply chain integration requires alignment of goals and objectives both across organizations in the supply chain and across functions within the trading partners in the supply chain. Also required are communication and information linkages across organizations and processes. In this chapter, we have briefly outlined the critical supply chain strategy decisions that require alignment, the key execution processes that must be aligned and linked, and the enabling infrastructure elements needed to support the strategy and execution decisions. We also identified 14 important challenges companies will face in attempting to improve the integration of their supply chains.
Chapter 3: Supply Chain Strategies

Introduction

Chapter 3 provides information about critical strategies impacting achievement of supply chain integration and performance across functions, enterprises and geographies in support of the business strategy. Each of the four sections focuses on a specific strategy area, i.e. strategic vision, insourcing/outsourcing, segmentation and architecture, and product and service design. The sections begin with a brief introduction, followed by a series of conclusions, with selected illustrative practices. The critical strategies establish the competitive and supply chain agenda for firms, and directly impact supply chain processes, integration and performance. For example, the strategic vision lays the foundation for how the supply chain will contribute to achieving competitive advantage and the business strategy; outsourcing strategy impacts supply network structure, costs and location; segmentation and architecture strategy influences the number of customer-focused supply chains at a firm and competitive requirements; and product/service design results in increasing or decreasing supply chain complexity, cost and efficiency.

Section A: Strategic Vision

Effective integrated supply chain strategies are built on a clear and articulated vision of the organization’s future supply network. End-to-end supply chains, from external customers back to tier 1, 2, and 3 suppliers, can positively or negatively impact a company’s financial performance and customer loyalty. Therefore, it is incumbent on firms to develop a holistic supply chain strategic vision that includes aligned and linked customers, product/service design and development, manufacturing/operations, sourcing, logistics and suppliers.

In addition, the supply chain vision should focus on achieving leading-edge performance on key customer-driven metrics such as the customer experience, product/service innovation, quality, response time, flexibility and cost. An integrated supply chain vision establishes what a company wants to be and also drives supply chain strategy development and operating processes.

Following is a brief discussion of each of the strategies to be included in a vision for the supply chain. These strategies provide a framework around which to create a holistic supply chain vision for the future. These 10 strategies were consistently identified important factors by the respondents in field research interviews. They also reflect our conclusions about the necessary requirements for a robust strategic vision to achieve supply chain integration.

Strategic Vision Requirements for Supply Chain Integration and Performance

Winning Supply Chain Integration Strategy 1. Design segmented supply chains to improve customer service.

A supply chain vision begins with understanding the various needs of all of the external customer groups and understanding that segmented supply chains may be necessary to meet specific customer needs at required service levels. Applying the same supply chain strategies for all customers with different needs will likely result in sub-par performance.

For example, higher-cost, slower-moving products may require different logistic strategies and inventory policies than a fast-moving, lower-cost product line. Fashion-oriented electronics (cell phones) versus stable, high-volume electronics such as TVs may have different customers and require different supply chains to meet customer needs and profit targets. At ACO, for example,
Winning Supply Chain Integration Strategy 2. 
Cross-functional engagement in new product/service design and development and customer-order fulfillment.

Increasing emphasis on effective cross-functional teams was a consistent theme across the case study organizations. This includes teams engaged in establishing the supply chain architecture and decision-making about customer priorities in constrained supply situations. In addition, all companies had cross-functional and frequently cross-enterprise (primarily supply facing) teams involved in some aspect of new product/service development.

A cross-functional approach is critical to increasing the alignment and linkage between supply chain elements required to fill customer orders or develop new products. Without a cross-functional approach and information transparency, dysfunctional behaviors can occur. Examples of the behaviors, include designing new products using new components/materials when standard and certified parts are sufficient; giving priorities to less profitable customers who are the favorite of a powerful individual; providing standard customer service levels for unique customer segments; and utilizing suppliers that have commercial or technical competency, but not both.

Cross-functional and executive engagement also is important in the sales and operations planning process. This cross-functionality is essential to understand true supply and demand conditions, balance demand and supply and establish appropriate customer priorities.

Innovation of products, services and processes also is viewed as an important strategy at the companies visited. Cross-functional and enterprise include designing new product/service development, customer-focus groups, innovation teams, and supplier-, technical- and customer-facing innovation efforts. New product/service design for supply chain performance, especially customer-order fulfillment, is a critical element in the strategic vision. For example, CCO was fully integrating suppliers very early in its new product development to achieve product innovation and speed to market.

Winning Supply Chain Integration Strategy 3. 
Reduce product/service complexity to reduce costs and increase flexibility.

At least three of the firms visited identify product complexity reduction as part of their strategic vision for the future and were undertaking initiatives to reduce complexity. ECO is looking at product standardization as a means to be more competitive in its proposals to customers. ACO is attempting to reduce product complexity through parts standardization for subsystems not seen by the customer. It is also driving the use of standard versus unique parts and specifications early in the new product development process.

Winning Supply Chain Integration Strategy 4. 
Establish strategic core competencies and effectively manage outsourced operations to increase competitive advantage.

All of the firms visited are outsourcing and establishing or maintaining a strategic focus on core competencies as part of their strategic vision. The most significant drivers are cost, focus on the firm's core competencies and doing work internally where it has competitive advantage. Outsourcing decisions, and the global location of outsourced suppliers, significantly affect supply chain integration and performance. As the global footprint increases, integration of the extended supply chain becomes more complex, influencing logistics, supplier development and inventory decisions.

In addition, when outsourcing decisions are executed, the opportunity for quality and delivery problems increases. Careful attention to the execution of the outsourcing at outsourced suppliers with appropriate levels of people support, information and process and practice transfer is required. Companies realize that transferring work with a “hands-off” approach to the outsourced supplier frequently leads to poor performance.

Winning Supply Chain Integration Strategy 5. 
Develop a global supply base to meet global customer requirements and achieve competitive costs.

Another key element of a holistic supply chain strategic vision is the development of a global supply base of the correct size to meet customer requirements anywhere in the world. All of the firms participating in the research are global and are concerned about how many suppliers to have, where they should be located and what role they should play, such as low-cost producer or innovation provider.

In addition, the capability of the supply base to meet current and future customer requirements and align with customer-order fulfillment and new product/service development processes is viewed as critical. Because speed and agility are important, it is therefore imperative to have a highly capable and responsive supply base, or supply chain performance will falter.
For example, at CCO, the ability of an outsourced supplier to provide for a perfect new product launch, both regionally and worldwide, when combined with concurrent advertising and other promotional programs is absolutely necessary for the product to be a financial success. Without highly effective global supply base management and strategic sourcing, the product introduction could have failed. In addition at SCO, with global manufacturing locations and customers, supplier locations to provide flexibility and low cost to the buying company worldwide has to be established.

Winning Supply Chain Integration Strategy 6. Create information transparency across the supply chain to deliver value-added information to decision makers.

Information transparency is another critical element of the strategic vision. Alignment and linkage with performance cannot be achieved without timely, correct information being provided across functions and enterprises. However, the strategy requires that only appropriate value-added information be provided to decision-makers.

For example, during a visit to a supplier of ACO, we learned about the capability of the supplier to provide hour-by-hour status information about the progress of products through various manufacturing processes. Clearly, this was information overload and ACO chose not to regularly access this information. However, we did observe that needed information about actual customer requirements (versus forecast) was not always available, negatively affecting supply chain performance. This important information could be made available with improved customer collaboration.

Winning Supply Chain Integration Strategy 7. Use a focused sales-operations planning process to balance demand and supply.

A key element of effective supply chains at all firms visited is some form of sales and operations planning to balance supply and demand. This balancing process requires that constrained capacities and goods or services be allocated to the correct customers. Whether a manufacturing or service firm, this balancing of supply and demand by cross-functional sales and operation planning groups is required to achieve effective supply chain performance. Effective sales and operations planning must be, and is generally part of a firm’s strategic vision for the supply chain.

Winning Supply Chain Integration Strategy 8. Design a global supply chain footprint (design, manufacturing, logistics, and so forth) to serve global customers.

Each of the companies visited is global and competes in markets worldwide. To be competitive, they all are concerned with the appropriateness of their global footprint, including where they design and develop products and services; where they produce; and where logistics centers from which they distribute are located. The footprint decisions are all made in alignment with the needs and locations of their current and future customers.

For example, ACO has design centers in North America and Europe, reflecting differences in taste and use. ECO has operations centers near all major customer project locations. At CCO and LCO, suppliers are located by country and region to quickly meet changing customer requirements.


All firms view correct metrics as critical to achieving high-performance aligned and linked supply chains. If metrics are functionally measured and rewarded, alignment and linkage across functions or organizations is not likely to be fully achieved. The firms believe that customer-driven metrics are important to establish, but are grappling with transformation from functional- to customer-driven metrics.

For example, at ECO, the company is working to establish valid return-on-investment measures linked to customers. ACO links performance to profitability by products/customer. Customer quality and warranty costs also are being used to drive behavior internally and with suppliers. Customer-driven metrics could be used to further align and link elements in the supply chain by having all groups work toward improved performance on these metrics, and demonstrate how functional performance directly contributes to customer service and satisfaction.

Winning Supply Chain Integration Strategy 10. Highly capable human resources provide the glue.

Each of the organizations visited discuss and demonstrate the importance of electronic information systems. However all organizations, when asked about the relative importance among systems or people, indicate that highly capable people are the “glue” that holds functions and companies together in meeting customer requirements.

Examples include how people are able to make decisions and create unique solutions to unforeseen problems. Without the people element, supply chains are more likely to fail or provide poor performance. Without full system capability, organizations could still perform,...
although at a lower level. The overall perception is that the human element is more critical than the systems element. Clearly the human resource element is an element of the go-forward supply chain strategic vision.

Conclusions
Based on our research, it seems unlikely that many firms have established complete end-to-end supply chain visions of the future. However, many organizations have created a partial supply chain vision. For example, a firm may define the supply chain as its external supply network, its new product development, its customer-order fulfillment processes or its supply chain information system. A firm also may focus, somewhat singularly, on cost, quality or customer service as its performance objective, which frequently is also a dominant functional objective. However, focus on any one of these individual areas or metrics would be a stand-alone initiative that would be unlikely to provide the highest levels of overall competitiveness across all elements of the supply chain.

Based on our research with many firms, any supply chain strategic vision and resulting strategies should be approached holistically — taking into account customers, product and service design, manufacturing/operations, sourcing and logistics elements. To do otherwise may lead to partial and sometimes incorrect supply chain strategies. We suggest that firms review the previous 10 elements and establish the mantra that “We will …” for each of the 10, which then establishes a strategic vision.

However, our research has revealed that implementation of the strategic vision for integrated supply chains is a long and complex transformation. Therefore, implementation must be broken down into prioritized projects with focused and fast execution to achieve significant and sustainable results.

Section B: Insourcing/Outsourcing
Insourcing/outsourcing decisions and their implementation are extremely complex and impact the ability of a firm to achieve supply chain integration and company-wide goals and objectives. Decisions to outsource manufacturing or services to distant and less developed geographies may affect the ability to effectively communicate electronically and synchronize demand with supply. Poor transitioning of work to outsourced suppliers can impact both alignment and linkage over extended periods of time. Due to inadequate or incorrect information regarding transitioned requirements and processes, integration issues may never be fully resolved. In addition, the outsourcing of complex work to potential competitors may limit the degree of supply chain integration that can be achieved.

To achieve supply chain integration and performance with outsourced suppliers, consideration and attention must be given to internal and external core competencies; who the outsourced suppliers will be and where they are located; their overall capabilities including information systems; and the transition and execution plan to maintain or enhance supply chain integration and performance. Additionally, outsourcing decisions influence the footprint of the supply base and impact the ability of suppliers to meet customer requirements including cost, responsiveness, on-time delivery, quality, technology and sustainability goals. The overall supply chain architecture can also be affected.

Based on our findings, the following conclusions have been reached that focus on the development and execution of the firm’s insourcing/outsourcing strategy and resulting impact on supply chain integration and performance. Selected supporting practices for the conclusions are discussed.

Winning Supply Chain Integration Strategy 1.
An executive level outsourcing/insourcing committee is required to establish a firm’s core competencies, strategic direction and insourcing/outsourcing patterns to achieve company financial goals and objectives, recognizing that supply chain issues should be considered when making these decisions.

Illustrative Practices
At ACO, an executive outsourcing team develops a list of “core processes at the company.” The executive team reaches agreement about what is most fundamental and important to the strategic success of the business. For example, “critical machining” could affect quality and have a significant impact on extended warranty costs. In addition, the integration of other manufacturing work could provide a significant cost advantage.

When establishing the core processes, the executive team also:

- Establishes the likely future state (three to five years)
- Establishes the justification/logic/financial impact of their decision
- Identifies manufacturing facilities requiring possible changeover
- Estimates annual savings (if appropriate) and capital requirements
If ACO is not able to identify critical competitive advantages to produce an item, it is put on an “to be outsourced” list, and specific items are therefore outsourced.

In addition, continuous review of core items by the executive team forces consideration of changes in the supply chain (and suppliers) that could impact the core items required to support new market segments or support existing market segments in new ways. Supply chain alignment, linkage and performance are considered in the decisions.

At CCO outsourcing/insourcing decisions are made by product category on a global basis. The executive decision-making team insources products when it has a core competency and outsources other products because of ease of manufacturing, volume consolidation and supplier scale capabilities and experience. Business model performance is maximized based on effective and efficient supply chains.

Specifically, CCO insourcing/outsourcing decisions take into account global business and sourcing strategies; effective asset utilization; the impact on supply chain architecture emphasizing effectiveness, including cost; core competencies and recognition that these competencies change over time; and positioning of work where it can be most economically and effectively performed to support customers.

At SCO, executive level insourcing/outsourcing decisions are based primarily on fixed asset utilization and the development of new manufacturing technologies. When demand exceeds supply, work is outsourced and vice versa. This enables firm performance to be maximized during slow periods. As new manufacturer technologies are implemented, products build using older technology many be outsourced, taking with them older technology.

In addition, SCO has internal capabilities to do the same work as suppliers, enabling on-going change in the mix of work done internally and externally. SCO also has visibility to supplier technology because of its outsourcing strategy and gained additional insights into second-tier suppliers, enabling greater influence on both tier-1 and tier-2 suppliers in line with business objectives.

The challenge with this insourcing/outsourcing strategy is to achieve alignment with suppliers with whom the company also competes. Sharing of future plans and technology roadmaps can be limited under these circumstances. While risk is shifted to suppliers in slow times, but when business exceeds SCO’s internal capacity, in good times when supplier capacity is needed, it may not be available because the supplier has other customer alternatives.

Overall, this model can create alignment and linkage problems with the external suppliers. However, SCO, in executing the strategy, attempts to provide ongoing work to the outsourced supplier(s) across multiple products to maintain suppliers’ interest, commitment and supply chain integration.

ECO has traditionally maintained engineering work internally. However, to meet increased global demand, an executive group outsourced selected engineering work to lower-cost countries such as India. This requires new linkages between ECO and the outsourced suppliers to assure an effective and integrated service supply chain.

As insourcing/outsourcing decisions and patterns are established by executive committees, or top-level persons charged with execution, a critical requirement was the assurance that appropriate alignment and linkages were in place with the key players to ensure positive supply chain performance. It appears that the required attention at correct organization levels is sometimes inadequate to ensure integration. This is especially the case when purchase price reduction is the primary focus of the outsourcing.

**Winning Supply Chain Integration Strategy 2.** When making insourcing/outsourcing decisions, a systematic process applied by the executive team will enhance the competitive analysis and minimize negative impacts on supply chain integration and performance. At ACO, the decision process illustrated in Figure 7 is applied. “Core processes” are critically important to the success of the business. “Variable processes” are those that might be insourced or outsourced, frequently based on capacity utilization. “Definite make” items are not included in Figure 7.

**Illustrative Practices**

During the competitive analyses, internal and external costs, investments and supply chain factors are considered. For example, the annual product cost analysis is performed using competitor product teardowns. Based on the results of these analyses, consideration is given to changing the manufacturing footprint, product design and insourcing/outsourcing mix. In addition, annual cost reduction targets are established for ACO products/processes based on the analysis. Also, all plants are asked to benchmark productivity/process performance against each other and drive total cost, including supply chain costs, to lowest possible levels using lean/Six Sigma approaches. Extended supply chain considerations are also more fully evaluated in the process as more products are being outsourced to low-cost producers worldwide.
This and prior research have identified both insourcing/outsourcing processes and numerous competitive factors to consider when making these decisions on a systematic basis. Insourcing/outsourcing decisions can affect the alignment and linkage across the supply chain and system architecture. However, the more robust the competitive analyses, the less likely it is that the insourcing/outsourcing decision will negatively impact supply chain integration. For a complete discussion of factors to include in the competitive analyses, see Outsourcing Strategically for Sustainable Competitive Advantage.4

Winning Supply Chain Integration Strategy 3. When work is outsourced, transition teams should be established with detailed and comprehensive plans to minimize supply chain integration problems and improve supply chain performance.

Illustrative Practices
Specific supporting practice examples of excellent transitions are few. However, prior research4 (Blascovich 2005) and problem transitions identified from this research (e.g. poor quality, inability to meet volume requirements, excessive cost and inadequate communications) strongly suggest that supply chain integration and performance suffer if work is poorly transitioned.

At ACO, if there is a shifting of production to China or Mexico from North America, new fully integrated supply chains are required to ensure that customers will continue to receive the same or higher customer service levels. Decisions about when to switch work depend on establishing new end-to-end supply chains capable of delivering high-quality products to customers worldwide.

At CCO, failure to determine the full impact of outsourcing or switching global suppliers will negatively impact the introduction of new products worldwide. This is due to the required synchronization of advertising and promotion, product development (chemical combinations) and establishment of production facilities to serve geographically disbursed markets with an effective product launch.

**Conclusions**

Strategic insourcing and outsourcing decisions can positively or negatively influence overall company and supply chain performance. As supply chains are extended worldwide, firms should evaluate insourcing/outsourcing decisions and their impact not only at the firm level in terms of financial performance, but also on current supply chain integration levels and resulting supply chain performance and customer satisfaction.

**Section C: Supply Chain Segmentation and Architecture**

In this section, we focus on good practices related to structure of the supply chain. Both the physical structure (architecture) and the conceptual structure (segmentation) of the supply chain have an important impact on the alignment of goals and objectives across organizations in the supply chain. Ideally, these goals and objectives are oriented toward maximizing value for the end customer.

Supply chain segmentation broadens the familiar concept of segmentation that includes differential channels, service levels and relationship types for different market segments, but also includes segmentation of the upstream supply network. Supply network segmentation could help align the upstream portion of the supply chain to provide the best support for key market segments.

**Winning Supply Chain Integration Strategy 1.**

Supply chain alignment and linkage are enhanced by appropriate segmentation of the customer base. Customer segments should be identified by focusing on volume, variety, profitability and customer requirements.

**Illustrative Practices**

ECO segments its supply chains by major lines of business — Energy and Chemicals; Industrial and Infrastructure; and Government and Power. Although the business in all segments is project-based engineering and construction, the nature of the projects varies significantly across segments. Strategic planning, sales and marketing, and project execution are organizationally focused around these customer segments.

The major lines of business are also further segmented. Energy and Chemicals, for example, has separate project execution groups for upstream (petroleum exploration and production), downstream (petroleum refining and marketing) and chemical. Because the business is project-based, and the construction projects can be located virtually anywhere in the world — often in underdeveloped areas of the world where transportation infrastructure is limited — the supply chain architecture, i.e. physical supply chain for getting materials to project sites is unique to each project.

At SCO, following assembly/test, the downstream supply chain is separated into two major segments, corresponding to two major markets that have different requirements. The two channels are the Original Equipment Manufacturer/Contract Manufacturer (OEM/CM) channel and the Distributor/Retail (DR) channel.

The DR channel supplies chips and chipsets to distributors, which sell to a wide variety of customers, including retail customers and to resellers who are systems builders. Sales to this channel include price protection on unsold merchandise and the right to return some unsold merchandise. This channel has a lower profitability for SCO. In this channel, distributors are used to hold inventory. SCO will accept returns from this channel, so a return network has been established for the retail channel. This channel has a lower priority for receiving goods in short supply, than the OEM/CM channel. Moreover, these customers are very price sensitive and can be more easily won back based on price competition when products become available.

The OEM/CM channel supplies chips and chipsets to the OEM manufacturers directly to their contract manufacturers. This distribution channel is further separated, depending on the needs of the customer. Some products are shipped to customer third-party logistics centers, from which the customers or their CMs draw inventory as needed. Some products are shipped directly to the OEM manufacturing facilities. Finally, some products are shipped directly to the CMs.

The segmentation of the downstream supply chain corresponds to the different needs of the markets. The OEM/CM market is the largest and most profitable for SCO and comprises relatively few customers. This channel is much more closely controlled by SCO in terms of transportation, delivery and inventory planning. SCO works closely with its major customers.
to ensure timely product delivery that matches up with forecasted and actual demand.

In the distributor/retail channel, SCO depends on distributors to manage the inventory and distribution for thousands of smaller customers. While this market segment is not unimportant, SCO does not have the resources to manage this channel as closely as the OEM/CM channel, nor does the profitability of this channel justify allocation of large amounts of resources.

The level of supply chain integration with the two major distribution channels differs substantially. For the OEM/CM manufacturing channels, SCO has dedicated personnel working with major customers to help create forecasts, shape demand, oversee commitments and work on issues and problems as they arise. These people have a major voice in shaping the demands that are put into the sales and operations planning (SOP) process at SCO for its customers. They are a major channel of communication with their customers about commitments and shipments.

For the distribution/retail channel, SCO takes forecasts and orders as they are submitted by distributors. The process is much more mechanical in nature and, as a result, requires fewer resources. The demands for this channel have a lower priority in the sales and operations planning process.

In the SOP process, SCO recognizes the different priorities and profitability of the two channels and allocates supply accordingly. It also is acutely aware of the economics of wafer manufacturing and schedules wafer plant production centrally, allowing SCO to achieve the best combination of wafer plant efficiency and customer-order fulfillment. This optimal combination is heavily weighted in favor of wafer plant efficiency.

ACO is transitioning away from being primarily driven by a major customer who would take output as available — a factory distribution model. The new orientation is a customer-centric model focusing on three customer segments — construction, “big box” retail, and national accounts.

ACO differentiates among these segments on two dimensions — (1) the lead time for ACO service to the customer and (2) the level of collaboration between ACO and the customer (see Figure 8). The national accounts and construction trade partners, though relatively few in number, represent a major portion of ACO’s total sales volume. This volume justifies the additional cost and effort to provide superior service in terms of lead times and perfect orders (i.e. order line fill rate, percent damage free, invoiced accurately, shipped complete). The higher levels of collaboration with national accounts and private label product customers may take a variety of forms. With national accounts, collaboration is focused more on forecasting, planning and scheduling, resulting in high service levels. With private label customers, collaboration often also includes product design efforts.

Overall, North American factories are now expected to support each of the brands to build loyalties. A new customer-focused order management system has been established so that priorities can be set, by customer, on a corporate basis without intervention by sales and other persons.

In addition, ACO developed a high/low inventory strategy that moved low-volume SKUs into slow-moving large regional warehouses, while maintaining six warehouses for fast moving/high-volume SKUs. Segmentation of the customer base is viewed as critical to overall performance success.

LCO serves both corporate-owned and independently owned properties across all of the brands (representing different lodging “categories”) in its parent company’s portfolio. LCO has effectively organized to align with the needs of its customers by dividing the supply chain into national and regional/local distribution channels and suppliers. This allows the company to leverage volume across brands and geography as much as possible, while also meeting local needs for fresh food and products, and local services and short lead time deliveries.

Winning Supply Chain Integration Strategy 2. Priorities, objectives and levels of service should be tailored to reflect the importance and varying demands of different customer segments; however it will be possible to standardize many processes and procedures across segments.

Illustrative Practices
LCO has aligned with its parent company’s brands, from the value-priced to the high-end properties, by employing its own brand management personnel. It meets the various brands’ disparate needs effectively and efficiently by using the same processes and procedures but fine-tuning them to the different brands as needed.

ECO has segmented its markets, and for example, shares much more information with key customers. However once ECO wins a project, the project team structure, roles and responsibilities, and operating procedures are very similar across the segments. On the supply side, although the project teams do the buying
for their project, supply market intelligence gathering and supplier performance tracking are centralized processes managed by the Strategic Sourcing organization. Strategic Sourcing is also responsible for supplier relationship management with key suppliers, across all projects.

At SCO, customer order processing differs for the two major market segments (OEM/CM and DR). SCO is much more closely connected to the relatively few customers in the more profitable OEM/CM segment. SCO has dedicated personnel for dealing with each of the customers in this segment, and collaborates closely in developing demand forecasts with these customers. In the DR segment, customer order processing is much more of a “mechanical” process. The demand information from the two market segments feeds a single sales and operations planning process. SOP recognizes the different priorities of the two market segments, but there is only one sales and operations planning process.

Winning Supply Chain Integration Strategy 3.

On the supply side, the supplier base should be segmented, based on criticality of suppliers and/or the categories they supply. Different segments of the supply base will be managed through different types of relationships, with closer, more integrated relationships with the most important supplier segments.

Illustrative Practices

At ECO, there is significant overlap in the supply bases used across the lines of business, but segmentation takes place based on strategic importance. Strategic suppliers are those who provide materials and/or technologies that are critical to the success of a project from a cost and/or operating performance perspective. ECO has identified about 10 percent of its suppliers as strategic suppliers, and executes Supplier Relationship Agreements (SRAs) with those suppliers. SRAs are long-term agreements that provide the framework for a much higher level of information sharing and collaboration between ECO and the strategic suppliers than what occurs with the rest of the supply base. Strategic suppliers are also much more likely to be brought in during the very early stages of a project — the Front End Engineering and Design (FEED).

At LCO, an important segmentation in the supply base is between national and regional/local suppliers. LCO corporate carries out strategic sourcing and signs national contracts with manufacturers. Regional offices contract with regional and local suppliers, mostly distributors, for fresh foods and beverages.
Figure 9
Equipment, Material Delivery

**Domestic Project – Physical Flows**

S1
S2
S3

ECO Coordinated

**International Project – Physical Flows**

S1
S2
S3

Marshaling Site(s)

ECO Coordinated

Figure 10
Information Flows

S1
S2
S3

ECO

Client

(selective)
Another important segmentation occurs among Projects, and Contracts and Supply Management (operating materials/services). Projects include refurbishing one or more properties or a complete brand. (The LCO-managed supply chain does not include construction or real estate — it is only concerned with “dry-wall in.”) LCO project managers work on specifications details and develop statements of work for new construction or major renovation. Actual buying goes through LCO category managers who buy from contractors and capital suppliers. Contracts and Supply Management includes three major categories: food and beverage, rooms and property operations. These category managers buy from food and beverage suppliers and supplier of room and building provisions.

Winning Supply Chain Integration Strategy 4. Supply chain architecture should support the varying priorities and objectives across different customer and supplier segments.

Illustrative Practices
At ECO, the physical architecture of the supply chain is fairly straightforward, though by no means easy to manage. Construction takes place on-site, so there is no finished product delivery channel per se. Project sites may be virtually anywhere in the world, either onshore or offshore. Even when dealing with the same customer, most projects and their sites will be unique, and the supply architecture will be different for each project.

Logistics is a critical part of a project supply chain. For international projects, logistics may comprise 10 percent to 13 percent of the cost of equipment and material. Equipment and material delivery is handled differently for domestic versus international projects (see Figure 9). For domestic projects, material and equipment are generally shipped directly from suppliers to the job site. For international projects, materials and equipment are moved from suppliers to one or more marshaling sites, and then moved to the job site. In either case, ECO coordinates the transportation.

Information flows in ECO’s supply chains are primarily echelon-to-echelon (as is true for most supply chains). On a selective basis however, there is also three-way communication among the ECO, the ECO’s client and a supplier (see Figure 10). This type of communication typically only occurs with a strategic supplier to better coordinate design and planning decisions.

In some cases, on the client’s initiative, this three-way link may be taken to another level. For a key set of interrelated technologies, like instrumentation and control systems, an ECO client sometimes awards responsibility for that portion of the technology and design to a provider the client believes has a clear and supportable technical and/or execution advantage over the other providers. This provider, known as the Master Instrumentation and Control Contractor (MICC), takes on a portion of the responsibilities that would traditionally fall to ECO. All field construction activities remain with ECO; the MICC only provides assistance and support. This interaction is coordinated through an Integrated Control Execution (ICE) team composed of representatives from all three organizations (see Figure 11).

Winning Supply Chain Integration Strategy 5. Supply base consolidation is helping to simplify the supply chain and to achieve cost advantages through greater leverage. These objectives, however, must be balanced, in some cases, with the need for local supply and short lead times. Supply base architecture must balance these competing priorities.

Illustrative Practices
In North America, ECO has Supplier Relationship Agreements with several carriers, both truckload and LTL, both regional and national. Carrier capacity is limited, especially when special equipment is needed for oversized loads, so it’s necessary to have backup.

Internationally, it is important to consolidate shipments as much as possible to manage cost. Ideally, ECO would like to charter a ship, or at least a part of a ship. It is relatively easy to consolidate shipments within a project. It is much more challenging to consolidate shipments across multiple projects, and this is done only on a limited basis. Capacity can be a problem when it’s necessary to ship large pieces of equipment — only three ships in the world can handle a piece weighing more than 1,000 tons.

The diversity of destinations and the frequency with which they change present challenges. There are a plethora of import regulations and customs clearance rules of which to keep track. ECO uses the services of freight forwarders, but also needs to maintain knowledge of the rules and regulations internally. In the past six to seven years, ECO has reduced the number of freight forwarders it works with from 28 to four. These four have developed the capability to interact electronically with ECO’s materials management system to facilitate coordination and communication.

In SCO’s supply chain, the majority of assembly and test facilities — both SCOs and subcontractors — are located offshore in countries such as China, Malaysia, the Philippines and Costa Rica. (Most OEM/CM manufacturing facilities are in Asia, so locating the assembly and test locations in Asia reduces transportation
costs and times.) The locations for manufacturing facilities are selected mainly on location economics and the availability of a qualified labor force. However, about 50 percent of chips are shipped to CMs in Asia.

ACO faces several trade-offs in selecting its supply chain architecture:

1. Manufacturing cost versus lead times — One large assembly plant with economies of scale has lower units costs but delivery times that multiple smaller plants located closer to the actual markets.
2. Labor costs versus inventory costs — Plant locations must be transparent to customers. A plant in Mexico may require four days of finished inventory, while a plant in China may require 30 days of finished inventory.
3. Innovation centers versus cost centers — The profit in Germany for the U.S. market could be increased by $100 per unit if manufactured in Mexico.

LCO has to continually reassess sourcing through national versus regional/local sourcing strategies. The trade-offs are the usual — volume leverage versus local service. Hotels are very sensitive and eager to do business with local suppliers as they depend to some extent on local customers for part of their revenue. On the other hand, they also like the lower prices that can result from national contracts.

Conclusions
The ability to align supply chain performance with the value or profitability of various customer segments is a major opportunity. Complexity is a critical challenge.

The organizations studied here continue to struggle with the question of how to manage the varying requirements of multiple customers and multiple products or product lines.

Section D: Product/Service Design

Effective product/service design decisions can positively affect firm and supply chain performance when design decisions take into account:

- Customer requirements
- Total cost
- Product/service complexity reduction
- Complexity of manufacturing/operations and produceability
- Availability of the technology in the quantities required at competitive cost levels
- Packaging
- Transportation/logistics cost-weight, size, and configuration
- Quality
- Sustainability
- Postponement

Internal and external alignment and linkage are needed to ensure that these issues are considered when making design decisions.

In addition, for new product/service development to maximize supply chain performance, alignment and linkage must be improved among functions such as purchasing, manufacturing/operations, engineering, product development, customers, et al. The alignment
and linkage must be internal and cross-enterprise to achieve design for supply chain objectives, including faster and more innovative new product/service development and perfect product/service launches/introductions.

**Winning Supply Chain Integration Strategy 1.**
Product/service design for supply chain can enhance supply chain and firm performance.

**Illustrative Practices**
At ACO there were communications problems regarding specifications with suppliers causing quality and supply chain problems. For example, ACO purchased a small component costing less than 1 cent, for which a quality parameter was not specified at a third-tier supplier. The component failed, creating supply chain, quality and cost problems. The corrective strategy for this, and other similar problems, is to further define the requirements using a standard specification in new products and providing the specification throughout the supply chain. In addition, the company established a lead engineer/design person responsible for overseeing the implementation and communications of specifications up and down the supply chain, thereby improving alignment and linkage, and reducing quality problems.

At CCO, the development of a new product with multiple chemical ingredients requires collaboration early in the development process with commercial teams, regional product teams, purchasing and suppliers to ensure that correct formula specifications are established based on regional customer preferences. New product development is coordinated with product introduction schedules requiring valid demand forecasts for different formulas for different regions, with supporting supplier capabilities. New product development requires early collaboration across functions internally and with suppliers to ensure new products are successfully launched and meet regional customer needs and profit goals. Additionally, at CCO, reduction of package size based on innovation design results in more shipments per pallet, reducing logistics costs.

At ACO, the implementation of modular designs in new product development leads to a global strategy, but with regional execution. This strategy requires a globally aligned supply chain with regional differences in supplier locations supporting geographically disbursed customers. Cost and flexibility improvements are achieved.

**Winning Supply Chain Integration Strategy 2.**
Cross-functional teams are required to facilitate internal supply chain integration at the product/service design stage and to facilitate design for supply chain.

**Illustrative Practices**
At ACO, cross-functional teams are established at the new product development stage with a project leader and core team. The project leader is usually a technical person and the core team includes:

- Technology
- Purchasing
- Logistics
- Brand
- Industrial design
- Marketing
- Manufacturing
- Finance

The objectives are to improve new product development and enhance design for supply chain considerations.

At CCO, new product developments frequently require early collaboration with commercial and regional product teams, purchasing and suppliers to ensure correct product definitions are established based on varying regional customer needs. New product development is coordinated with product introduction schedules requiring valid product demand forecasts for different regions. Collaboration across internal business activities is required to ensure successful product launches and profitability.

**Winning Supply Chain Integration Strategy 3.**
Participation by customers and suppliers at the product/service design stage enables enhanced supply chain integration and performance.

**Illustrative Practices**
At ECO a standard process has procurement working with strategic suppliers during the front-end engineering and design of a project, before detailed specifications are finalized. In these cases the best thinking and core capabilities of suppliers can be applied to help develop the best design solution (“best value”) for ECO’s customers. It is estimated that this collaboration at the design stage can reduce total project time by 10 percent to 15 percent and reduce project cost by 4 percent to 8 percent.

ACO does not maintain in-house expertise in electronic components. Therefore, design/specifications are generally established by the supplier for the components, even though ACO at times could do the design. An ACO team evaluates each product set of components for insourcing/outsourcing. The team includes product design, procurement, the electronics design community and sometimes a supplier representative to establish the best design specifications.

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To keep the supply chain for specific components aligned and linked with its plans, SCO shares technology and new product road maps with its supply base to give them the opportunity to prepare for the new products. SCO also obtains road maps from its suppliers for new manufacturing technology and from its customers for new products.

On the sell side, SCO shares technology and new product road maps with its customers. SCO reviews historical demand for current products, and discusses its strategies and how customers see their markets and demand unfolding. The dialog includes market scenarios and customer strategies to win market share.

For SCO, new product development cycle times are getting shorter, and the life cycle of tools/equipment is decreasing from years to months. To help manage this increased pace of activity and help ensure new product introduction success, SCO’s supplier established a new position of New Products Liaison. The liaison coordinates the efforts of SCO’s new product development team and SCO supplier’s factory readiness so that certified capacity is in place when SCO is ready to launch the new product.

When working on a new product at LCO, supply brings designers, manufacturers, distributors, brands and suppliers together to develop the best possible product to meet customer needs taking into account the design impact on the supply chain. This process has resulted in a number of innovative products, e.g. including an in-room coffee-making system, that requires extensive integration among suppliers.

Conclusions

The ability of a firm to link its product/service design decisions to its impact on supply chain effectiveness and efficiency can positively impact overall firm performance. However, the current alignment and linkage of product/service design to the supply chain(s) is still at an early stage of development. There is increasing recognition that design for the supply chain will provide results and should be a strategic focus, as exemplified by company efforts at complexity reduction and part standardization.

Overall Conclusions

Achieving competitive advantage through superior supply chain performance requires effective supply chain processes. However, strategic foundation elements provide the basis for superior supply chain performance. These foundation elements include:

1. A holistic and well communicated strategic vision of the future supply chain to guide behavior across all functions and organizations making up the supply chain
2. A robust insourcing/outsourcing strategy development process, implemented at the executive level, to establish where work will be done in the supply chain so as to gain competitive advantage
3. Segmentation of customers and suppliers to create supply chain network(s) that will best meet various customer segment needs
4. New product/service development that is cross-functional and cross-enterprise and works to achieve “Design for Supply Chain” effectiveness to create early and long-lasting benefits in the product/service life cycle

This field research provides insight about practices that firms are implementing to achieve the above strategic foundation elements that enabling effective supply chain performance.

No matter how good forecasts are, how effective sales and operations planning processes are, or whether the lowest purchase price is achieved, the firm cannot maximize supply chain performance and its business strategy without:

1. All supply chain stakeholders pulling in the same direction
2. An effective insourcing/outsourcing strategy
3. Correct customer segmentation and supply chain architecture
4. A design for supply chain strategy

Lacking correct and highly competitive strategies in each of these areas will limit overall supply chain performance and business competitiveness.
Introduction

Supply Chain Strategy, discussed in Chapter 3, addresses how supply chain management supports the Business Strategy. In turn, a set of processes — “supply chain execution processes” — support supply chain strategy. This set of execution processes essentially defines how the firm matches supply with demand to deliver value to the customer. Included in this chapter are the processes for forecasting and demand management, order promising, operations planning, material planning and supply management. In this chapter, we examine some of the good practices the firms included in our study are using to match supply and demand in ways that advance the broader supply chain strategy.

Section A: Order Fulfillment — Supply-Facing Processes

For most enterprises, suppliers are a key part of the organization's competitive success. Managing that supply base effectively entails a range of processes that coordinate planning and decision-making between the two firms. This includes the sharing of forecasts and productions plans, as well as the coordination of planning activities to work toward optimal results for the final customer.

Winning Supply Chain Integration Strategy 1. Supply chain alignment and linkage are enhanced by frequent, regular communication between an organization and its suppliers regarding demand and supply conditions — both current and future.

Illustrative Practices

ECO, through its supplier relationship agreements (SRAs), creates a framework for providing strategic suppliers with visibility of future requirements. Particularly when demand outstrips capacity for key materials and technologies, this enables ECO and its suppliers to make more realistic and achievable promises regarding project schedule and cost. The company holds quarterly meetings with its SRA suppliers to discuss future business, capacity and material availability issues as well as new material and technology developments.

Once ECO wins a project bid, the schedule remains relatively stable. There are some issues related to design changes during projects that can be disruptive, particularly if they are not communicated effectively. In contract to schedule change ECO's suppliers are often challenged to prioritize customer demands. The main point of contact for suppliers during a project is the ECO project team, and there may be multiple project teams making demands on the same supplier. This causes confusion for the suppliers as they try to figure out the true priorities across projects.

ACO has one of its key suppliers operating on a build-to-forecast basis, with an eight-month horizon broken into daily (nearer-term) and weekly (longer-term) buckets. The first 10 to 20 days of the forecast are supposed to be frozen. Forecast accuracy, however, is not very good — volume variability is low, but mix variability is high. The supplier copes with this variability through a postponement strategy using inventory. Furthermore, because most of the equipment it uses for ACO parts is dedicated to ACO, it has flexibility to react to changes in ACO demand. Other suppliers are less adept at dealing with schedule changes, and ACO deals with these situations reactively to keep its plants running — incurring higher logistics costs in the process.

SCO has many touch points between itself and its assembly/test subcontractor, creating the opportunity
for multiple and continuous communications between the organizations. This includes regularly scheduled meetings — semiannual, quarterly and weekly — and in some cases on-site representatives co-located with the supplier. These meetings provide the opportunity to share information on supply and demand, and provide visibility to both organizations. SCO provides a six-month demand forecast to the supplier. Forecast accuracy is not good (as is typical in this industry), making it difficult to maintain a stable schedule. Months three through six of the forecast are revised monthly, and the supplier is asked to make commitments against this revised forecast. When capacity is short, the supplier will allocate capacity to its customers, and the supplier will ask SCO to prioritize its orders.

Winning Supply Chain Integration Strategy 2. Supply chain alignment and linkage are enhanced by a combination of linked information systems and person-to-person communication between an organization and its suppliers.

Illustrative Practices
The evidence from ECO regarding linked information systems is more negative than positive. ECO does not have effectively linked systems for sharing information with suppliers. This is viewed as both a challenge and an opportunity within the organization. Several respondents cite improved interorganizational systems as an objective, which they believe would improve planning and execution. One specific opportunity for improvement is communicating information regarding design changes to suppliers.

ACO’s key suppliers can access quality, demand, and accounts payable data from ACO's system. There also is a frequent person-to-person interaction to deal with questions or problems as they arise. One key supplier, however, sometimes receives conflicting demand signals from the system versus ACO personnel. ACO, for its part, could access detailed production data from this supplier in real time, but opts for periodic reports instead. A new ERP system at ACO, with improved inventory management strategy and improved forecasting and demand management, may enable the company to move to a form of build-to-order operation that would improve effectiveness and efficiency in the supply chain.

SCO and its key supplier exchange large amounts of data through RosettaNet, but not all data is available in a timely fashion. The supplier is currently unable to make line schedule status/capacity utilization data available to SCO in real time, which would be very useful to SCO as it schedules its own plants. Beyond the extensive electronically shared information, supply/demand planning also requires some person-to-person communication.

Winning Supply Chain Integration Strategy 3. Effectiveness and efficiency of customer-order fulfillment are promoted by collaborative decision-making between an organization and its key suppliers.

Illustrative Practices
ECO collaborates with key suppliers in multiple ways — on project design/specification and pursuit of new projects, on forecasting and capacity planning, and on process improvement. The company cites important benefits from this collaboration, including reduction of project schedules, lower-cost designs through better design decisions, reduced procurement cycle time and effort, and overall better value for the customer due to higher quality design and better reliability on project execution.

ACO works with both customers and suppliers on what to hold in inventory and where to hold it, which helps the company deal with demand fluctuations. A key ACO supplier also reports that ACO is better at sharing risk than the supplier’s other customers.

There has been some limited collaboration between ACO and its key supplier on product design, but this could be (and probably will be) expanded. ACO and other OEMs have limited design engineering capacity available and are reluctant to expand this capacity. However, market conditions require more new product launches. These conditions will likely drive greater collaboration with suppliers on product design. This type of collaboration can save time as well as cost (e.g. material, manufacturing and rework).

SCO successfully collaborates with its key supplier on some types of decisions — but not all. For example, it collaborates effectively on new product introductions and cost/process improvements. On the other hand, there is not much coordination or collaboration in the organization’s sales and operations planning processes. There are too many competing objectives to make this latter type of collaboration practical.

LCO encourages suppliers to bring forward innovative ideas. LCO can share these ideas quickly with brand managers and hotel owners, and can speed time to market. LCO controls the financial relationship with suppliers and uses this to improve overall supplier relationships.
Winning Supply Chain Integration Strategy 4.
Clear communication of performance expectations and rewards help support supply chain alignment.

Illustrative Practices
Cost, execution to schedule and capacity are key supplier selection criteria for ECO. Capacity and execution to schedule are closely interrelated. Suppliers who excel on these dimensions can expect to be rewarded with future business. ECO develops specific targets for SRA content on future projects.

SCO has service level agreements in place with its key suppliers, focused on performance to commitments. A critical objective for the supplier is to meet its commitments to all customers, and this can create some tension when capacity is short and SCO pushes for additional allocation. SCO works collaboratively with the supplier to improve the supplier's costs and performance. While SCO asks for these cost improvements to be reflected in price reductions, the supplier can apply the process improvements to the rest of its business and benefit from improved margins with other customers.

LCO has direct interaction with its hotel customers as well as suppliers, and uses this interaction to better align supplier performance and capabilities with hotel needs. LCO carefully considers which purchase categories are good candidates for leveraging through national contracts and which are better sourced locally or regionally. There are nearly 3,000 hotels to be served, and many suppliers are not equipped to effectively serve that many locations. Locally or regionally sourced categories enhance suppliers' ability to meet the hotels' requirements and to respond to short lead time requests. LCO is working at building stronger long-term relationships with suppliers, which would give it greater influence over supplier quality and service.

Conclusions
Linking information systems continues to be a challenge. We did not find fully linked information systems between the focus company and its suppliers in any of the cases we examined. There are gaps and inconsistencies in information shared in all the cases we examined and there is evidence this seriously diminishes supply chain effectiveness and efficiency. While linked information systems would not eliminate the need for person-to-person communication for frequent, routine exchanges of hard data — inventory levels, forecasts, requirements — better-linked information systems could speed up communication. It also could help to ensure accuracy and consistency of the information being used up and down the supply chain.

Supplier performance expectations generally seem to be clear, but in the face of tight supply/demand conditions, which some of the focus firms are facing, these expectations may not necessarily be achievable. The focus firms were generally trying to help their suppliers perform up to their expectations.

Section B: Order Fulfillment — Customer-Facing Processes

Introduction
Customer-facing processes span the focus company and its first-tier customers, and help align and link the activities of the companies. In some cases the process may extend further down the supply chain to perhaps the final consumer. Additionally, especially for service companies, some customer-facing processes may also extend up the supply chain and directly link to first-tier suppliers, serving to connect three tiers in the supply chain. This is the case for both LCO and ECO, the two service providers in our study. Thus these processes are both customer-facing and supply-facing.

Customer-facing processes are shared among the focus company and its first-tier customers, with none of the trading partners fully controlling the process. All participating companies help design the process, make decisions about resources devoted to operating the process, contribute data to the processes and make decisions based on analyses of the data.

Several customer-facing processes, particularly forecasting, customer ordering and customer commits, directly impact and interact with the Sales Operations Plan (SOP), which is addressed in another section of this report. The SOP could be considered a customer-facing process, but because it is controlled internally and also interacts with many internal processes, we have chosen to consider it separately.

The nature of the business model determines, in part, the nature of the supply chain and the customer-facing processes (see Figure 12). Each type of business model has different requirements for customer-facing processes. For example, for products that are repetitively manufactured, the focus company must keep continually informed about the ongoing use or sale of its products by its first-tier customers. In contrast, service companies working on projects need constant communications about shifting project designs, schedules and budgets.

Winning Supply Chain Integration Strategy 1.
Companies require an advanced and formal forecasting process that is informed by multiple data
streams, including customer input, third-party input and historical data. It should be supported by software, mathematical models, and experienced and informed human judgment.

Regular communication with key customers is needed at several levels of the organization to ensure the best possible forecast from the customer. The forecasts should be as realistic as possible and free of “unfounded optimism.” Typically, forecasts will occur at several levels, at a high level for overall demand, to mix by product line and channel, to individual SKUs. The lowest level will be dictated by the needs of sales and operations planning to create actual factory orders. Forecasts may be generated by top-down or bottom-up analyses and must be reconciled into a final forecast for input to the SOP.

The forecasting system also must be closely aligned with the demand management process. Demand management activities are designed to influence the actual orders received from the customers and should be done in collaboration with customers. Demand management activities include promotions, advertising, special pricing, special availability, and so forth — all intended to influence customer demand. Forecasting and demand management processes should be tied to the financial plan.

**Illustrative Practices**
SCO has a complex and sophisticated forecasting process. High bandwidth communications with key customers is established by assigning personnel dedicated to the customers at several levels of the SCO organization. At the order-fulfillment level, personnel work on developing demand forecasts with the customers. The process includes regular meetings to review customer short-term and long-term forecasts, and customer marketing or product introduction plans that will influence future demand. The SCO account personnel have access to past demand data to help them assess and judge the new customer forecasts. They also develop a good understanding of the customers’ forecasting process. In this way, SCO gets the best possible forecast from the customer, subject to limitations on what data the customer will share with the SCO and the adequacies of the customer’s own forecasting processes.

After constructing the informed forecasts from its key customers, SCO then assembles the forecasts across customers, geographies and product. One of the major challenges at this point is that the total of the customer forecasts often exceed the total market demand forecasted by SCO. In such cases, SCO must rationalize the competing forecasts and adjust the forecasts from the key customers to fit the market reality. This often
becomes an exercise in guessing which customer will capture market share at the expense of another customer. At SCO, forecast rationalization is a sequential process and can involve many people at multiple levels of the organization. Arriving at the final “judged demand” for some products can be a slow and time-consuming process.

SCO tries to construct judged forecasts that have an equal chance of being over or under actual demand. To forecast total market demand, SCO uses historical data, third-party data and sophisticated models. It updates product forecasts quarterly, monthly and weekly to reflect the latest actual demand information from customers plus any overall market trends. Once a “judged forecast” is derived, this forecast is used as input to the SOP.

The tier-1 customer approach to provide data for forecasts will influence to a large extent the accuracy of the forecasts. Customers with powerful and centralized supply departments generally provide better forecasts than customers with decentralized or less powerful supply departments.

The CCO forecasting group forecasts for all CCO facilities and categories worldwide, including five CCO facilities and 10 subcontractors in the United States. CCO finds that it is better at forecasting demand for its subcontractors than the subs can do for themselves.

At CCO, the first two quarters of the forecast are a consensus forecast done on a monthly basis. Point of sale (POS) data currently is not used to support this effort.

The responsibility of the forecasting group includes:

- Forecasts by category/product
- Forecasts by customer/account
- Monthly consensus forecast by category, current quarter plus one
- Constructing and interpreting the statistical forecast
- Taking into consideration data from Collaborative Planning Forecasting Requirements (CPFR) activities. CCO has daily conversations with its major customer concerning requirements.
- Collaboration with multidisciplinary selling teams on promotions and stock levels.

POS data are very detailed and need to be aggregated into planning units that are useful to CCO. A project is under way with CCO’s ERP supplier to write a module to assist in the analysis of the POS data.

Because of the complexity of products, competitors and consumer behavior, CCO needs to fully understand the “demand transaction” at the retail level to manage demand and create accurate forecasts. Working with its trade partners, the company is trying to acquire insights into consumer behavior at the retail level, including what spurs the customer to buy a product and what is the point of differentiation between its products and competing products. In some categories, fully two-thirds of the purchasing decisions are made at the store at the shelf. Marketing initiatives aimed at shoppers help CCO gain insights that are linked to its business planning. This requires CCO to design the replacement strategy from the retail shelf backwards through distribution centers, transportation and eventually to the factories. It relies on several technologies to help do this, not all of which are in a high state of development. CCO uses point of sale data, which should be a perfect record of what is actually sold at retail. Point of sale (POS) data are not always clean, may differ among retail customers, and are not well integrated with its other systems, including forecasting and order entry. RFID technology eventually will help CCO track goods in transit, but the technology must stabilize before it can be widely implemented. The data available from the retail sites need cleansing and need to be transformed into actionable information before they can be used.

Many of the promotional techniques that are used in the consumer products industry are based on strongly held beliefs about what they do to traffic and image, and the strategy of each of the individual retailers. The process of changing the plan to increase consumption and return on investment takes education and negotiation with the retailer to reach a win-win agreement.

In Mexico, for example, CCO expected that temporary price reductions would have better consumer pull than a bonus pack or a value pack, such as 20 percent more toothpaste. However, after analyzing more than 90 promotions with a variety of customers, the data showed that Mexican consumers place more value and benefit (and CCO gets better return on investment) with packs that offer 20 percent more product free at the same price than price reductions.

CCO has a business planning initiative to improve the effectiveness of promotional activities to manage demand. This initiative allows the company to plan brands with customers to a great level of detail over an extended timeframe in an automated way. The system has a component in it that allows CCO to assess the return on investment by promotional activity, by customer and in the aggregate.
CCO has also found non-promotional approaches to managing demand. For example, in the past CCO has experienced a hockey stick pattern of customer orders at the end of the quarter as orders are ramped up to meet quarterly targets. The company has ameliorated this with one major customer by no longer holding orders until they are complete, but rather shipping partial orders all month long.

ACO is transitioning from a factory push approach designed to satisfy a historic major customer to a customer-driven approach to satisfy newer customers. However, the historical customer has helped ACO by absorbing uncertainty in the marketplace by placing firm fixed orders for products. Newer customers that are growing in importance require ACO to absorb the risk in the demand uncertainty.

ACO has a central fulfillment group with representatives from demand planning and marketing (but not sales) that receives forecast data on Friday and meets on Monday to set factory and customer priorities. In setting priorities, the group takes three views:

- Brand — a top-down look at what will be needed to support the brand
- Channel — a bottom-up look at what is needed by sales channel and customer
- Product — what is available in inventory and what can the factories produce

As input to the forecasting processes the group considers:

- Historical data
- Quarterly data
- Statistical forecast constructed using their factory planning software
- Point of sale data, although the discrepancies between forecasts and POS data limit the use of this data
- Other data from trade partners
- Inventory at the customer level — store inventory is the best predictor of actual orders from trade partners.
- SKU’s inventory at each of its distribution centers

Despite the best efforts of the group and the many data sources, forecasts remain somewhat inaccurate and from time-to-time create supply chain distortions.

At ACO, forecasting/planning is done for brands and planning at two levels — order demand forecast and operational forecast. The operational forecast is the level of orders required to meet financial commitments and drives the manufacturing plan. The difference between order demand forecast and the operational forecast is the “gap." Demand-management actions to close the gap include promotions, advertisements and price concessions. If these do not produce the desired results, a change in the operational and financial plans may be required to close the gap.

One key customer has a highly integrated interface with ACO and uses the following customer-fulfillment metrics to evaluate the performance of ACO.

- Fill rate — there are many reasons why fill rate can change, however these are not investigated due to workload. A fill rate less than 90 percent is a problem.
- Service
- Availability
- Special order sales fill rate
- Damage and returns

Even though this customer is well integrated, ACO believes this customer could improve its forecasts by smoothing out the peaks and valleys, updating its forecast by product models, and accounting for price increases at the retail level (which distort the inventory count at the stores). The customer also has too many people “touching” the forecasts and creating repetitive orders to ensure booking of the “order.” Furthermore, it can, and does, change its minimum/maximum inventory parameters without informing ACO. This contributes to ACO’s forecasting challenges.

For its part, the customer would like ACO to carry more inventory, improve its use of POS data and improve its forecasting. This would enable the customer to concentrate on selling the ACO products and not have to be as concerned about availability of products.

Overall at ACO, there appears to be disconnects at both the system and data level with key customers. However, people-to-people interactions overcome many of the system and data problems.

Winning Supply Chain Integration Strategy 2.
A process that reflects the competitive priorities of the company is needed to resolve allocations issues when demand exceeds supply.

Illustrative Practices
At SCO, when products are in short supply, the “commits process” can be slow and/or late due to the need to allocate available product to customers. The allocation decisions require the attention of executives at the highest levels of the organization. Products are allocated to geographic areas, then to customers within geographic areas. This resolution process delays the communication of “commitments,” or order acceptance,
back to customers beyond the standard window set by the company. The delay in commits causes problems for OEMs and their contract manufacturers because of the uncertainty about the supply of SCO products that will be available for their assembly lines.

The commits process gets orders officially into the SCO order “backlog” (essentially an order accepting process). The process has a four-month horizon that is updated monthly. The four-month-out commits report is a “stake in the ground” and gives customers assurance of the committed supply. Working from the commits, SCO and the customer identify supply coverage gaps and try to work change orders to close the gaps. De-commits occasionally occur, but the company tries to work them out agreeably with the customer.

For example, one major customer submits demand forecasts monthly, with a six-month horizon. SCO responds back with commits through the fourth month of the horizon. There is a weekly opportunity for the customer to request changes (pull up, push back, increase/decrease orders). SCO account managers submit customer requests for changes and respond with a yes or no answer to the customer. The customer is typically firming up orders only four to six weeks ahead, which is not enough time for SCO to respond to all requests.

Major customers can cancel orders at any time except for last two weeks of SCO’s financial quarter. The terms and conditions for cancellations are somewhat incompatible with the SCO build schedule. Customer demand is often overstated because there is no penalty for cancellation. SCO’s competitive landscape has led it to reduce cancellation penalties and frozen order periods.

At SCO, the many judgments made in translating customer demand into “judged demand,” commits and build plans slow down the sales and operations planning process, stretches out the commits window and makes it hard to reconcile final judged demand back to specific customer demands. Furthermore, it is not always clear why certain judgments about forecasts are made, which makes it difficult to explain to customers why their demand was not fully met. The process is even slower for products in short supply, as the allocation problem extends the cycle time.

Historically at ACO, order management and processing were very poor. Up to 8,000 faxes a day with orders and changes were received, and it was almost impossible to make delivery promises that could always be honored. ACO sales representatives and their customers could access system records of finished goods inventory and place reservations against the inventory, resulting in false priorities that were very difficult to sort out.

ACO is in transition from a production push to a market pull strategy, relying more on actual demand and less on forecasts. In this transition, ACO recognizes that there are problems to be solved in:

- Forecasts
- Order management
- Supply chain information system
- Collaboration with trading partners
- Availability and accuracy of POS data
- Supplier visibility with actual demands
- Supplier schedules
- Low-cost country (LCC) suppliers

Specific strategies in place or planned to support this include:

- A new order management system with a central fulfillment team/process to establish priorities.
- Improved sales and operations planning
- Customer segmentation
- Supply chain information system investment
- Supply chain architecture improvement
- Point of sale data availability improvement
- Enhanced collaboration with trading partners
- Product design and information sharing
- Improved visibility of ACO requirements to suppliers

ACO also segments its customer base to help prioritize orders and service levels. Customer segmentation is done by level of cooperation and order lead time as illustrated in Figure 13.

**Winning Supply Chain Integration Strategy 3. Logistics, inventory management and return processes need to reflect a company’s competitive priorities.**

**Illustrative Practices**

At ACO, the inventory plan identifies optimum weeks of inventory at key points in the supply chain. SCO assesses the demand risks and market opportunities, assesses how much inventory is required to support demand, decides how much inventory SCO is willing to hold and then sets inventory targets by SKU. The inventory strategies are also set at the product family level to determine unique chip set inventory. A challenge in inventory planning is predicting “bin splits,” that is the actual yield of finished chips by SKU. For example, actual processing speed may vary among finished chips, creating differing mixes of SKUs.

Once products have completed assembly/test at either SCO or a subcontractor facility, SCO takes responsibility
for shipping the product to the customer. This results in better service to the customer. The cost of shipping is charged back to the customer. Customer service metrics are in place to measure actual shipments against customer commits. However, SCO loses visibility on product shipments once they leave SCO distribution centers. Actual delivery dates are not known unless the shipper or customer informs SCO.

Returns are not accepted by the company from the OEM supply chain except for discrepant material claims. Some product returns are accepted from the distributor/retail supply chain along with discrepant material returns. Processes are in place to handle both kinds of returns. However, disposition decisions from the planning group for returned discrepant materials are sometimes delayed and, in some cases may take months to be made, resulting in slow inventory turns for this material.

SCO customers are allowed to cancel actual orders, with no penalty, up to the scheduled ship date. (This is the case except at the end of the SCO's financial quarters, when restrictions are placed on cancellations due to their impact on the quarter end financials.) Canceled orders can create major problems for SCO and may confuse the outcome of the laborious commits process. SCO either has to absorb the canceled orders as extra inventory or try to reallocate it to another customer.

In the consumer products sector, retail customer consolidation has put significant pressures on manufacturers to reduce inventory levels. Going forward, CCO expects to see more mergers in the retail segment resulting in additional pressure to reduce inventories. Accordingly, CCO has several initiatives under way to reduce inventory in the pipeline. Maintaining visibility of customer inventory is a key initiative. Additionally, CCO decided it could not effectively manage SKU inventory at its 100-plus sites and is moving to consolidate distribution and manufacturing sites around the world.

Uncertainty in forecasts and variability in shipping time at ACO have both contributed to high inventory. In addition, low-cost country sourcing results in extended and uncertain lead-times. Uncertain supplier schedules lead to the need for greater safety stock in the pipeline. In sum, ACO was challenged to forecast accurately, control inventory levels and maintain customer service levels.

To improve performance, ACO developed a high/low sales volume inventory strategy. Low-value, slow-moving SKUs, such as some cook-tops, are put into big regional warehouses. These warehouses hold the slow moving inventories and can guarantee delivery within a couple of weeks. At the same time, six high-volume warehouses were established that promise two- to three-day delivery after receipt of an order. ACO's strategy is to first put the distribution network infrastructure in place, consolidate slow-moving inventory in the regional warehouses, and implement the six high-
volume distribution centers. It is expected that these moves will reduce overall inventory, increase customer service levels, and finally reduce sales, administrative and operational expenses.

As an example of how this strategy works, consider a “big-box” customer of ACO. When this customer’s volume was small, ACO delivered directly to the retail stores from the ACO distribution centers. However, as volume grew and the number of retail outlets grew, shipping merchandise to stores became a major challenge. To improve service levels to the consumer, the customer eventually had to change its logistics strategy by having 35 percent of its volume shipped directly to the stores and the rest shipped to its warehouse. The stores were then supplied from the warehouse based on actual demand. The customer warehouses are resupplied from the fast-moving inventory distribution centers established by ACO.

This “big-box” customer goal is to hold one week of supply of ACO products, although the actual is now closer to two to three weeks, but down from five to six weeks. This inventory goal includes inventory in the distribution centers and the stores, including display stock at more than 400 stores. The customer also wants special orders delivered in seven to 10 days. The customer wants a 98 percent fill rate, while the current average fill rate is 85 percent to 88 percent. Both ACO and its big-box customer like full truckload shipments, which work well for distribution centers but not for store deliveries.

To meet all of these requirements for the customer, ACO has to essentially take responsibility for the customer’s inventory. It resupplies the customer warehouses from its own distribution centers, based on forecasts and actual inventories. Although these are both subject to error, fast reorders from the distribution centers help make up for the discrepancies.

Winning Supply Chain Integration Strategy 4. For companies in service industries, such as ECO and LCO, customer-facing processes must also include tier-one suppliers who provide goods and services directly to tier-one customers.

Illustrative Practices
ECO sees relationship management with its important clients as key to its business. There is a senior management link with these clients, and regularly scheduled communication between ECO and the clients throughout the year. ECO’s key clients share advance information on future projects, giving ECO the critical information it needs to begin long-range capacity planning. This includes both internal ECO capacity (primarily engineering resources) and supplier capacity. ECO has been effective at working collaboratively with key clients during the Front End Engineering and Design (FEED) phase of projects. This gives ECO the ability to influence project design decisions, playing to the company’s and its suppliers’ strengths, and in the process, delivering a design that results in lower long-term operating costs for the customer.

Once a client awards a project, ECO forms a project team, which includes representation from project management, estimating, engineering, procurement (including logistics and materials management), construction and operations management. The company’s project team works collaboratively with the client early in the project to identify strategic equipment and materials, to agree on an approach to awarding business, and to identify and select suppliers. The client has ongoing representation on the project team.

At ECO, project complexity arises in part because of the unique aspects of each project. Because designs, products, and services are new and often unique to the project, there are often no past practices or past designs to fall back on. A broad band of communication is needed among ECO and its customers to ensure that the project is completed as desired, and of course, on schedule and on budget.

LCO is involved with both projects and ongoing operations. LCO and the hotel brands align strategy by teaming on projects and new products. Many projects target one hotel brand that includes many properties within the brand. These projects all include suppliers that provide designs, furnishings, and capital equipment. LCO customers are the hotel properties but their customer-facing processes must also include the suppliers.

A recent large project was the refurbishing of a mid-price brand with about 1,400 hotels, with approximately half of the properties owned by franchisees. About 70 to 80 new hotels a year were being added to the chain. A new brand strategy was developed to design and introduce new products and services to this hotel chain. During the renovation program, 180 hotels per month were refurbished.

The project work process for LCO is shown in Figure 14.

In large projects, a major problem is communication with third-party designers concerning specifications. Designers give property owners quotes from several suppliers but have no samples to show. This makes it difficult for the property owners and franchisees to make good decisions and arrive at specifications. Designers also may recommend third-party suppliers from which they get rebates — a clear conflict of
interest. There also can be issues with the specifications sent to suppliers. Different suppliers may interpret the specs differently and submit disparate quotes that are difficult to compare. LCO is developing a qualified supplier list with which designers are encouraged to work. Projects also can have problems when the scope of work is wrong and when short lead time changes are made to the standard package.

A key to supplier involvement is to understand the brand’s strategy and provide goal clarity to common suppliers across brands. LCO does well at aligning itself with the needs of its hotel customers, with in-house brand managers, with third-party designers and with suppliers. It does this by employing brand management personnel in supply management who work directly with corporate brand managers, hotel owners, the design team and suppliers. LCO brings suppliers into the projects early to provide ideas for innovative products and services. LCO leverages high-quality suppliers to provide package requirements for projects. LCO also help with the financing schedule and manages the “buy” for the projects.

For ongoing operations, LCO is also very important to the brands. Regional sourcing managers sell the LCO purchasing programs to properties through property visits and personal communications. LCO works with suppliers to better serve its hotel customers, for example by specifying minimum order sizes and by aggregating demands across properties.

LCO is credit-friendly with the hotels and will open an account for any LCO-flagged hotel. Owned and managed hotels have unlimited credit. Franchised hotels have limits if they have a poor payment history. When payment problems occur, LCO does not enforce credit holds, but reviews what happened to create the problem. To emphasize LCO service to the properties, collection representatives are now called account representatives.

**Winning Supply Chain Integration Strategy 5.**

Good information systems are necessary to support customer-facing processes.

None of our focus companies had implemented extensive information systems to support their
customer-facing supply chain processes. A few information system initiatives are identified below:

- CCO is developing a unique system with its ERP provider to support top-line growth. The objective of the system is to improve selection techniques and partnering approaches with the major retailers in each market/country to increase the growth rate by the activities (promotions) CCO chooses to run.

- ACO is investing $12 million to develop an order fulfillment system.

- LCO has developed project management software to help it and its customers plan and execute large and small projects.

The opportunities for further information system development to support customer-facing processes are many and promise good returns. Two promising initiatives that are being pilot tested or are partially implemented are: (1) radio frequency identification (RFID) for tracking movement of goods and recording inventory levels and (2) use of point-of-sale data for forecasting demand and just-in-time replenishment. These technologies, especially POS, have been available for some time, but their potential has not yet been fully exploited.

Conclusion
Effective customer-facing processes are critical to successfully linking customer requirements to the planning systems of the focus company. Assuming that effective alignment has been achieved by good business and supply chain strategies, effective linkages become the major challenge. Imperfect forecasts, limited capacity and restricted flexibility dictate a combination of information system linkages and person-to-person communication to keep supply chains functioning at a high level. Enhancement of information system linkages, data validity and decision support is a never-ending task, even for the most advanced companies.

Section C: Sales and Operations Planning

The objective of Sales and Operations Planning (SOP) is to enable executive decision-makers to reach consensus on a single operating plan that allocates critical resources to achieve corporate performance targets. SOP should be a strategic process, not a tactical planning activity. It consists of setting the overall level of manufacturing output (production plan) and supply plan to best satisfy the planned levels of sales (forecasts), while meeting general business objectives of profitability, productivity, competitive customer lead times, customer priorities and so forth. One of the primary purposes of SOP is to establish production rates that will achieve the company’s objective of maintaining, raising or reducing inventories or backlogs, while keeping the workforce relatively stable. Sales and operations planning must extend through a planning horizon sufficient to plan and acquire the labor, equipment, facilities, material, services and finances required to accomplish the production plan.

The SOP must take into account:

- New product introduction planning
- Demand planning
- Supply planning
- Manufacturing planning
- Business and financial plans reconciliation

Sales and operations planning should include all lines of business and brands, all factories and regional operational facilities, and all strategic supply sources, including contract manufacturers.

Winning Supply Chain Integration Strategy 1. SOP requires a dedicated cross-functional team and high-level executive sponsorship and attention. Solid, trusting relationships with customers, strategic suppliers, senior managers and internal functions are critical to the success of the sales and operations planning.

Illustrative Practices
At CCO the SOP team includes representative from:

- Demand planning
- Enterprise-level planning
- Packaging
- Vendor managed inventory
- Fulfillment/logistics
- Transportation
- Warehousing

The CCO sales and operations planning team has responsibility for:

- All facilities and categories in the United States and worldwide, including five facilities and 10 subcontractors in United States
- Contract packaging (As CCO reduces its own facilities, subcontractors and contract packing increase in importance)
- Production plan
- Inventory plan
- Customer-service inventories
- Order fulfillment
- Linking with sales and marketing strategy, including quarterly planning
There is little excess capacity at CCO so a major issue is how to optimally use available capacity in a constrained environment. A separate team does the capacity planning by category. Product/SKU proliferation adds to the capacity planning challenge.

A key for effective sales and operations planning at CCO is interaction with the business units. The SOP team needs to continue to build relationships within the firm and strike a balance between regional needs and global performance.

The sales and operations planning process at SCO is particularly important and challenging because of the relatively long manufacturing lead time for chipsets (four months total lead time) and the very fast changes in the consumer marketplace for products using chipsets. This clash of velocity and cycle times creates the need for executive sponsorship to make the resources available to create and execute the SOP and to decide on the trade-offs that allow the competing cycles to mesh.

A manifestation of the importance of sales and operations planning at SCO was the combination of the sales and manufacturing groups into one Sales-Demand Organizational unit (SDO) that is responsible for sales and operations planning (see Figure 15). The newly combined organization should bring more discipline and balance to the competing demands of the fast-changing marketplace and the highly efficient manufacturing facilities. This high-level sponsorship of the SOP is particularly necessary to decide the necessary trade-offs for chipsets that are in short supply.

In addition to managing the six-month sales and operations planning process, the SDO looks out 12 months and is responsible for answering the question, “How do we best use the capacity we have?” A different group at SCO plans over a five-year horizon and is charged with answering the question, “How much capacity should we invest in?”

The Sales-Demand Organization partners with a large number of other SCO organizations including regional (for customer information and priorities); product divisions (for sales planning); factory (for production feasibility); and finance (for the revenue plan created from the unit forecasts). SDO tries to balance the upside/downside risk in the forecast. It tries not to chase demand with factory output but rather to absorb demand variability with inventory buffers.

SOP is closely tied to the corporate financial plan. The financial implications of the factory schedules on costs and customer commits on revenues are routinely calculated and reported. At the end of the financial quarter, SCO’s generous rules on order cancellations are suspended to avoid upsetting the end-of-quarter financial projections.

In the sales and operations planning process, the manufacturing needs of the SCO chip factories for high loading and stable schedules are generally given the highest priority, overriding both customer and supplier considerations. After factory priorities are met, other priorities such as meeting new orders, making changes in current orders, meeting inventory goals and scheduling suppliers are considered.

Overall, the SOP process works well at SCO within the overall capacity limits of factories and suppliers. There is good communications between the sales-demand organization, the SCO factories and other SCO units. The process has high visibility and includes high-level executives to resolve issues and make complex trade-off decisions. SCO has many talented people assigned on the process who understand and can cope with the complexity.

Sales and operations planning at ECO begins early in the “pursuit” phase of a project, well before the business has been awarded by the client. At this very early stage, ECO is working to understand, and in some cases, influence the resource requirements and the schedule for the project. It is a demand and supply balancing process in which ECO works with strategic suppliers and the client to come up with a project proposal that provides good value to the client, with achievable cost and schedule targets. ECO works with the strategic suppliers to understand technology and design options, capacity constraints and lead times. At the same time, it works with the client to understand the trade-offs that make sense in terms of project cost, operating cost and schedule. There is internal demand and supply balancing that must be considered too, as ECO attempts to adjust its engineering capacity to accommodate new projects.

ECO has built relationships with key clients in which the clients are willing to share significant advance information on future projects. This gives the company some long-term visibility of capacity requirements. Internally, this visibility gives it the ability to plan long-term engineering resource requirements. As current projects are completed, engineering resources can be redeployed, but in an environment of growing demand, ECO has to plan for additional resources. To achieve greater flexibility in this growth environment, it has been making greater use of contract engineers.
ECO, its clients and its strategic suppliers have recognized that by sharing key demand and supply information, they are better able to anticipate problems and look for solutions in advance rather than react to problems when they occur. Knowledge of which commodities/categories are likely to present challenges to cost or schedule gives ECO and its client the ability to develop achievable cost and schedule targets. The suppliers’ involvement in this process helps to gain their buy-in to the targets and gives all parties a common set of objectives.

ACO needs agile and adaptable product delivery. This is required because of uncertainty of demand from nearly all customers. While one key customer absorbs the uncertainty in the forecasts, the other key customers do not.

At ACO, sales and operations planning is centralized, uses a cross-functional order management team (that does not include representatives from sales), and is well executed. The group makes promises, allocates supply and fulfills orders. The team receives sales data on Fridays and meets Mondays to set priorities. The order management team reviews forecasts and demand by brand, market, channel (customers) and assesses product supply. One key issue ACO must consider the trade-off between optimizing case-fill versus on-time shipment. That is, ACO can ship available product on time and then backfill the remainder of the orders or maximize case-fill by holding the orders until the entire product is available and shipping late.

The SOP process is being implemented with a new Web-based technology and is proving to be an agile and adaptable product delivery initiative.
Winning Supply Chain Integration Strategy 2. Sales and operations planning requires reliable, valid, timely and accessible data on forecasts, inventory positions, internal factory capacity, supplier capacity, factory and supplier lead times, and sophisticated decision support systems. The output from SOP must be master schedules for the factories, planned inventories and customer commits.

Illustrative Practices
SCO has a well-organized approach to creating the master schedules for the factories that are result from sales and operations planning. SCO plans in monthly time buckets at the SKU level. The master schedule is "frozen solid" for one month out with limited short lead time changes accommodated in the second and third months out. Commits to forecasts are made in the fourth month. Forecasts are made for months five and six, but are used for planning purposes only. As the master schedule is "rolled" each month, the commits of month four become chip factory schedules for the new month three. The forecasts for month five roll to month four and are considered for commits. Forecasts for month six roll to month five and can be changed as appropriate and new forecasts appear in month six.

Wafer plants have a long manufacturing lead time and are not responsive to short lead time orders. SCO uses planned inventory and flexibility in assembly/test (AT) to absorb demand uncertainty. Actual orders are used to schedule and reschedule assembly/test production in SCO facilities and to give orders to assembly/test subcontractors.

The factory planners are very conservative about their planned output for the commits process four months out. This leaves room for improvements in commits to forecasts as the calendar rolls and forecast demand moves closer to the requested delivery dates. This approach makes the factories look good as they nearly always exceed their initial commits. However, it makes life difficult for SCO account managers and their customers because they cannot be sure that additional commits will be forthcoming to meet their forecasts, even though history suggests that more supply will be available for commits as the calendar is rolled.

As indicated in Figure 16, there are two key parts to the build plan — the wafer (chip) start plan (three-month lead time) and the finished goods build plan (three-week lead time). The judged demand forecast and the inventory plans are combined to get a net demand, which combined with factory capacity and commits are translated into a wafer start plan using an SCO in-house “solver” tool. The solver calculates inventory and allows scenario planning (sensitivity analysis with yields and inventory targets). The solver is not integrated with factory systems or the ERP system, but has access to all of the relevant information.

SCO plans finished goods at the SKU level in weekly buckets and the plan is updated weekly. Finished goods inventory level targets are set for each SKU. These targets can only be changed with the agreement of finance. The product planners are responsible for meeting the inventory targets.

The finished goods production process includes assembly and test (A/T). These processes may be completed at SCO facilities or may be completed by subcontractors or some combination of both. Dies from the SCO chip factories are provided as raw material to assembly and test. SCO does a good job of providing dies to assembly/test, so die availability is generally not a constraint. The key constrains are assembly and test capacity, and substrate availability.

The sales-demand organization submits build requests (actual orders) to assembly and test; assembly and test is expected to respond the same day with commits. It is at this point that the SOP process can go awry because capacity and commit information from the A/T subcontractors is not always complete or accurate. This creates uncertainty for SCO when making commits to its customers.

Because the A/T manufacturing process is relatively short and flexible and because a variety of dies are generally available in front of assembly and test, it is at this point in the manufacturing process that SCO can accommodate some short lead time changes in actual orders from its customers.

Winning Supply Chain Integration Strategy 3. The sales and operations planning process must be coordinated with the SOP process at suppliers.

Illustrative Practices
The business environment in the engineering construction sector is challenging. There has been significant growth in capital investment in projects, which is anticipated to continue for several years. At the same time, there has been little or no expansion of capacity in the supply for some key materials and equipment. ECO estimates that current demand already exceeds supplier capacity in some categories. These conditions threaten to cause slippage in project completion schedules.

The problem is exacerbated by two other factors. Many suppliers have experienced significant raw material price increases, placing cost pressure on current and
future projects. Also, there has been significant consolidation of the supply base for several important categories, and suppliers are reluctant to add capacity during a boom time, only to be left with idle resources when business slows down.

Early interaction with strategic suppliers is critical to ECO in developing an early understanding of where it might have problems meeting project cost or schedule targets. It has been able, in some cases, to “lock up” supplier capacity to ensure its ability to deliver on promises to clients. ECO has, in some cases, been able to induce a supplier to invest in new capabilities and capacity through a precommitment of business.

This visibility enables ECO to talk to suppliers about long-term supply. With its strategic suppliers, ECO will share information about future project opportunities (usually without identifying the client) in exchange for information from the supplier regarding issues such as current and projected shop loads, current and projected capacity availability, raw material availability and pricing pressure, current and projected lead times, and new products or technologies. This helps ECO with its cost and schedule estimating and gives it the opportunity to identify critical/bottleneck categories.

Conclusions
Sales and operations planning should be a strategic process and integration point for a company’s internal supply chain. SOP is a key supply chain link where all of the main elements of the supply chain converge — supply, manufacturing, sales and finance — and competing priorities are sorted out. SOP must be visible and supported at the highest levels of the organization. The process must be executed with highly capable people who can interact with many other units of the organization in a cooperative and trusting way. The process is data intensive and should be supported with good information systems and databases. Resources invested in creating and operating a good SOP will create generous return. The absence of such investment will show up as customer delivery shortfalls, factory cost overruns and missed financial plans.
Chapter 5: Critical Role of Supply Chain Enablers

Introduction

The enablers of supply chain integration are not strategies or processes, but can be described as organizational DNA, and as such, they significantly influence the performance of strategies and of processes. Our objective in this chapter is to discuss each of these enablers and to illustrate how the enablers impact business strategies, supply chain strategies and supply chain processes. The four enablers of critical importance to supply chain integration are: Communications and E-systems; Organization Structure and People; Metrics; and Trust.

Section A: Communications and E-Systems

Companies readily recognize the need for and the value of good communications internally and with their trading partners. They have formalized channels of communications that enable alignment among organizations and internal links for data exchange. Following is a look at how the companies in this study address communication issues.

Winning Supply Chain Integration Strategy 1. Frequent and regular people-to-people communication with buyers and suppliers at several levels in the organization is required for good supply chain integration.

Frequent and regular communication with trading partners is required to achieve effective supply chain integration. In particular, people-to-person communication is needed to build trust and collaboration, and to provide competitive differentiation. At the executive level, an exchange of information is needed on business strategies and directions, future business prospects, technology roadmaps and so forth. At lower organizational levels, regular reviews of sales and purchase requirements, contractual issues and problem-solving and prevention are needed. This is complemented by informal and irregular exchanges to address problems that pop up, to share new information and generally to grease the gears among the trading partners.

Illustrative Practices

Communications with Suppliers

ECO has frequent, regular communication with strategic suppliers about future business opportunities. There is a quarterly meeting scheduled to discuss these issues, as well as less formal communication between quarterly meetings. Discussions focus on the size and timing of the opportunities, and where there might be issues or concerns due to supplier shop load/capacity, material availability and lead times. This is also an opportunity for the supplier to update ECO on new products and technologies.

This communication is extremely valuable in giving the supplier visibility into future requirements and helping both ECO and its suppliers plan more effectively. More effective planning helps the company make achievable commitments to its clients and to deliver on those commitments.

SCO has created many touch points between itself and its assembly/test subcontractor that creates the opportunity for multiple and continuous communications between the organizations. These include:

1. Twice-yearly meetings with its assembly/test subcontractor to share technology roadmaps, outlook for product demand and new product introduction plans. Likewise, the assembly/test contractor shares information on its plans for manufacturing capability and capacity. High-level executives from both organizations participate in these discussions.
2. Quarterly meetings are conducted to discuss business volume forecasts, process improvements and problem resolutions.

3. There are weekly/daily discussions to review and discuss actual orders, change orders and commits from the suppliers.

Although broad bands of communications have been established between SCO and its suppliers, the need for communication volume is balanced with the need for control so that suppliers are hearing a consistent “voice of the customer.” Thus supplier access and communications are limited to designated SCO personnel.

At ACO, regular communications with suppliers include executive-to-executive contacts, discussions on planning/scheduling issues, cost reduction and contacts with contract manufacturers. Discussions on design for manufacturing and supply chain are starting to occur with suppliers.

Although communication with tier-1 suppliers is generally good, lack of communication with tier-2 and tier-3 suppliers also can create significant and costly supply chain problems. For example, a 1-cent diode from a third-tier supplier failed because of the lack of communication about a quality parameter from ACO.

Communications with Customers
In the engineering construction industry, communication with customers is particularly important in the early stages of a project, when making good design/specification decisions can have a major impact on cost, schedule and the quality of the ultimate product. ECO has a focus on exchanging information early in the project life that facilitates better design decisions. The process enables early input from both ECO and its key suppliers.

ECO talks regularly to its key clients about future projects. This gives the company critical information to begin long-range capacity planning. This includes both internal ECO capacity (primarily engineering resources) and supplier capacity.

SCO has executives assigned to oversee relationships with major customers. These executives are responsible for fostering relationships with the customers so information can be exchanged about technology roadmaps, new product development plans and overall forecasts of product demand.

Below the executive level, SCO has personnel assigned at the account and product level with major customers. These individuals are responsible for working with customers to review forecast and demand data on a regular basis. They help obtain the best possible demand picture from the customer and then relay that information back to SCO as the starting point for demand forecasting in the sales and operations planning process.

At the order fulfillment level, dedicated personnel work on developing actual orders and commits with the customers. The process includes regular meetings to review customer orders. It also helps facilitate short lead time change orders and relays commits to the customer with explanations about shortages and about assessing the likelihood of shortages being made up.

ACO holds regular meetings with major customers to discuss forecasts, orders and other factors, such as promotions that might affect future demand.

Internal Communications
Communications among functions that make up the internal supply chain are very important. The sales and operations planning function can be viewed as the network hub for these communications. Information must flow to this hub from the supply side, the customer side, the factories, and the business units with profit and loss responsibilities.

The SCO Sales-Demand Organization has good communications with a wide number of SCO organizations — regions for customer information and priorities; product divisions for sales plans; factories for production feasibility; and finance profit impacts. This information exchange is vital for creating a SOP that is realistic, cost-effective and customer responsive.

Winning Supply Chain Integration Strategy
People-to-people communication needs to be complemented by systematic and standardized exchange of information through e-systems. The e-systems should seamlessly connect trading partners.

Much of the communication critical for supply chain integration is person-to-person, but good system-to-system communication is also important and can be a major time and resource saver. Most companies have installed modern ERP systems that include MRP systems for internal planning and scheduling. These systems also provide communications and schedules to suppliers, and collect and manage information about demand from customers. Most of the systems also support the exchange of financial transactional links between organizations.

However, even at the transactional level, most of the systems lack true interoperability across trading partners.
and rely mostly on portals for information exchange. Moreover, most systems provide little support for supply chain alignment efforts.

Illustrative Practices

ECO has issues with compatibility of its systems and suppliers’ systems, although it is making progress in some areas. System issues at ECO include:

1. ECO is leading an industrywide effort to standardize one CAD tool that will facilitate sharing of design information on projects. It is anticipated that this capability will save labor, reduce lead times and ultimately reduce project cost.

2. ECO’s customer-demand inputs go into its homegrown material management system. This system tracks material from drawing through delivery to the job site. Suppliers’ ability to access data in this system is quite limited. Suppliers sometimes find that they are getting different information from different people on a project team. This adds to project lead time as the supplier works to find out the true specifications.

3. Project teams often run into outdated information in the clients’ Approved Manufacturers Lists that the team uses to select suppliers for RFQs.

4. On projects in which the client has designated a Master Instrumentation and Control Contractor (MICC), integration of work processes and systems across the three organizations (client, MICC, ECO) is lacking.

SCO has been a pioneer and driver in the development and use of RosettaNet with suppliers for the direct exchange of transaction data between information systems. SCO routinely exchanges large quantities of transaction data with suppliers using RosettaNet and is developing a version that will be cost effective for small suppliers.

SCO also has a supplier portal through which suppliers can download transactional order information. The SCO portal also facilitates communications among the company’s logistics, transportation and shippers.

ACO has an MRP system that drives the inventory systems, which are described as “good.” Its demand data in turn drives the suppliers’ MPS/MRP systems and requirements.

LCO runs an Oracle ERP-type system and an internally developed project management module that is integrated with the Oracle system. In addition, the company provides customers with two e-purchasing systems to use:

1. A desktop system for hotels to purchase low-value, one-off supplies, such as from a local hardware store.

2. A third-party provider-hosted system that includes the LCO online procurement portal and uses the provider’s E-Procurement and Financial Controls product suite. This suite is integrated with the LCO Oracle system.

LCO has project management software that includes such features as:

• Project management functionality to plan and track progress, develop budgets, timelines, specifications and payment programs for each project
• Templates for projects (e.g. rooms) are included
• Logistics integrated into supply tracking
• Populates software with project specs to generate RFP and requirements
• Creates purchase orders through the Oracle system

Despite the many systems in place, all of the companies in the study still conduct some transactions with their trading partners using spreadsheets and e-mail. For example, SCO receives its forecast data and actual orders from key customers on spreadsheets. This is due partly to SCO’s information technology security and firewall policies that do not allow transaction data (e.g. EDI) to flow into its computer network from the outside. The use of these informal systems introduces more opportunity for errors and missed information among all of the trading partners.

Winning Supply Chain Integration Strategy 3.

Companywide data warehouses with standardized and cleansed data will enable supply chain integration.

Cleansed data in a data warehouse will facilitate decision analysis and reliable data transactions between trading partners. Readily accessible data will help with supply chain analyses, including spend analysis, demand forecasting, supplier evaluation, order promising, capacity planning and contract administration.

Illustrative Practices

At ECO it is difficult to get some enterprise data, such as spend analysis or account management. Data management is also a challenge at the project level. In some cases, not enough attention is given to data
requirements upfront, so database design is not optimized for the project.

At SCO, inventory and product data has been rationalized across the corporation in its SAP system. This has created a companywide data warehouse with standardize data definitions for customers, suppliers, products, and inventory. Moreover, SCO is driving to achieve one instance of SAP, which will further enhance internal data integrity and standardization.

However, the SCO culture supports local creativity and the development of local decision support systems. Many of these tools are spreadsheet-based, not universally shared and have different data needs. While data accuracy in the data warehouse is generally good and data are readily available, the information is not always well linked to decision support systems. Furthermore, information transparency can be problematic because of numerous transformations needed between decision support tools.

Limits to supply chain effectiveness at ACO are driven by poor forecasting and the inability of e-systems or people-to-people communication to fully resolve the forecast error problems. ACO receives some e-system information from customers. This includes point-of-sale data and forecasts. However, the forecast data is not always accurate and is not always linked to POS data and/or the order system. Some customers provide data about store inventories that can be used for plant scheduling. However, except for major customers, inventory and forecasts are frequently inadequate for valid planning, resulting in the use of “best guesses.”

Conclusions

Although reliable and valid data may be available internally to a company, competing objectives among the supply chain partners may give rise to different strategies for sharing information. Customers routinely give inflated forecasts in time of tight supplies to ensure they receive adequate supplies of material. Manufacturing plants are often conservative in what they promise to ensure an orderly and efficient manufacturing schedule. Suppliers and subcontractors many times overstate their capacity information to receive as many orders as possible, knowing that a certain percentage of forecasted demand may not actually materialize.

Because supply chains are embedded in supply networks, unilateral optimization of any one supply chain is seldom possible. Nonetheless, better supply chain communications can go a long way toward establishing the boundaries of competition and cooperation, and can help create better alignment and linkages among firms.

Section B: Organization Structure and People

Organizational structures define the ways people will interact and relate to each other in an enterprise, including reporting structures, team membership, and roles and responsibilities. The wrong organizational structure can exclude key stakeholders and key resources from important decisions, and can make it very difficult for people to work collaboratively to achieve alignment and linkage. In addition, the capabilities of the people themselves are key to the success of all organizations. Working and making decisions in an integrated way demands skills and capabilities that need to be developed in many of today’s supply chain professionals.

Winning Supply Chain Integration Strategy 1. An appropriate combination of centralized and decentralized authority and responsibility is necessary to balance the need to leverage buying power with the need for flexibility and responsiveness to local requirements. A senior vice president or C-level supply chain executive helps to drive alignment and linkage in the supply chain.

Illustrative Practices

All five focus companies have C-level executives leading their supply chain organization. This gives the supply chain organization a voice in setting strategy for the enterprise and helps inject a “supply chain perspective” into the strategy-setting process.

At ACO, the direct material procurement groups are organized by region. Matrixed with these groups are global commodity managers who are responsible for the purchase categories used worldwide. Regional commodity managers are located at the plant level. The global commodity managers have helped to drive the company’s volume consolidation and low-cost country sourcing strategies, as well as the overall supply base strategy. The plant level procurement personnel focus their efforts on interfaces with selected suppliers in support of manufacturing.

CCO has global spend teams that coordinate the sourcing of selected commodities, both direct and indirect, across regions and product categories. These spend teams have driven the consolidation of dispersed databases into a common global database, the shift from ad hoc sourcing teams to permanent sourcing teams, and an increased focus on compliance across the organization.

Winning Supply Chain Integration Strategy 2. The supply chain organizational structure should support cross-functional alignment and collaboration.
Illustrative Practices
Historically, one part of the SCO organization was responsible for working with customers to generate demand forecasts and a different part of the organization was responsible for generating the factory schedules (supply) to meet the demand forecasts. While these two groups were supposed to work together to create the sales and operations plan, there were inherent conflicts as the groups had different objectives. The two groups were, in effect, trying to optimize two different objective functions. The sell side wanted to sell as much as possible, so it wanted to promise as much as possible. There was no downside to overestimating. The sell side focused on forecast accuracy, responsiveness, fulfillment and revenue. Supply wanted to promise as little as possible, so it could always make the schedule and could be a hero if it delivered more than promised. The supply side focused on inventory, stable build plans, delivery and cost.

To resolve this internal conflict, SCO merged its supply-side and demand-side planning organizations into a Sales-Demand Organization (SDO) team to get common alignment on goals and broader appreciation for the total business. The SDO's primary responsibilities include demand planning and commit strategies and developing product and inventory strategies to optimize supply and demand match. The SDO's primary responsibilities include demand planning and commit strategies and developing product and inventory strategies to optimize supply and demand match. Sales people are no longer part of the demand-planning activities, which results in a more realistic plan. There is now more collaboration across groups within SCO, but each group is still held accountable for making its own numbers. The SDO is led by two people both reporting to the senior vice president of sales and marketing.

Winning Supply Chain Integration Strategy 3.
A matrixed organization structure, with a customer/market focus, linked to segmentation strategies facilitates linkage and alignment.

Illustrative Practices
ACO has appointed its first vice president of supply chain, who reports to the executive vice president of marketing and supply chain. The VP of supply chain has responsibility for the key activities involved in customer-order fulfillment, including demand planning, forecasting, order entry/order management, network planning, logistics, inventory management, customer delivery, and supply forecast and planning. This change in the organization structure has helped support ACO's shift from a factory distribution model to a more customer-centric model.

Placing all of these activities under a single vice president facilitates the segmentation of the customer base and the integration of the supply chain segments that serve those customer segments. For example, as supply chain management in the North American Region became center-led, it could control and better manage customer priorities for available and short supply products. This was not possible in the past, when multiple functions and people had access to the customer/inventory database(s) and could change allocation and priorities somewhat at will.

This organizational strategy better aligns and links the most critical customer-facing processes and decisions. However, the supply facing side of the ACO supply chain is not linked well organizationally to the demand side. Procurement reports to the executive vice president of manufacturing and technology.

ECO's procurement department is organized into two groups — Procurement and Materials Management, and Strategic Sourcing. ECO procurement supports engineering and construction projects through a matrix structure in which procurement, logistics, and materials management personnel are tasked to an individual project, while maintaining a dotted-line responsibility to the corporate strategic sourcing organization. The project team stays together throughout the life of a project, which is often three years or more.

Strategic Sourcing supports the project team's work by providing supply market knowledge. It compares strategic suppliers' performance and competitiveness against other potential suppliers, and provides information on the supply market leaders to assist the project team in evaluating supplier quotations. This group also manages strategic sourcing for common materials/equipment and manages strategic supplier relationships.

Strategic Sourcing also reviews and approves the project procurement plan, the bidders list and the quotation summaries. It has the authority to disapprove these, but the project team can override that decision with justification, which may include client approval. Once project execution begins, Strategic Sourcing has little interaction with the client company regarding that project.

The project team, including resources from Engineering Management, Materials Management and Construction Management, works early in the project with the client to identify strategic materials and equipment, identify and select sources, and determine the sourcing approach, such as competitive bidding or use of existing agreements.

This organizational structure helps ensure alignment of goals and objectives between ECO and the client, as well as alignment across the procurement, engineering
and construction functions within ECO. The project team must come to agreement on these issues with the client, and the functional representatives take their “marching orders” from the team. This structure also facilitates communication and information sharing by placing the key functional representatives in direct daily contact with each other at the early stages of the project. They “buy as a team,” which accelerates the process when compared with “lobbing requirements over the wall.”

CCO has shifted its organizational structure from regionally based to product category-based supply chains. The category leader owns the capital investment and supply chain network configuration for the product category worldwide. Procurement personnel are matrixed into the category teams, and this structure helps support the firm’s drive toward stronger supply relationships.

SCO has executives assigned to oversee the relationships with major customers. These executives are responsible for fostering relationships with the customers so information can be exchanged that is mutually beneficial. This includes technology roadmaps, new product development plans and overall forecasts of product demand. In general, these relationships work well, though effectiveness varies somewhat from customer to customer.

On the sell side, SCO is organized by product, by customer and by region. These groups all have responsibility for the market intelligence and demand forecasting in their area of responsibility. The groups must reconcile the information from their various sources into a total demand forecast, short- and long-run, for chips and chipsets. This approach enables SCO to get a complete picture of demand while at the same time reconciling the inevitable optimistic forecasts at the customer level with macro forecasts at the regional and product level.

SCO has personnel assigned at the account and product level with major customers. These people are responsible for working with customers to review forecast and demand data on a regular basis. They try to get the best possible demand picture from the customer and then relay that information back to SCO as the starting point for demand forecasting in the sales and operations planning process.

The Business Management Team (BMT) at SCO consolidates demand from all of the customers in the Americas. This group also looks at the total market size in the Americas. From the aggregated customer demand and SCO’s total market demand forecast, BMT creates a “judged” demand for the total market.

Winning Supply Chain Integration Strategy 4. Integrated supply chain management requires people who understand the business beyond their narrow functional role.

Illustrative Practices
LCO has hired people with operational experience in the hospitality industry. These employees understand the business and can communicate effectively with both owners (internal clients) and suppliers.

The people at SCO who work in supply chain are bright and motivated. They are knowledgeable about their jobs and also about SCO’s business, and are genuinely interested in helping the business succeed. SCO personnel are well educated and have ready access to additional training. People are flexible and are regularly transferred to new positions within SCO so they gain in-depth knowledge of the business from several perspectives.

The people at SCO are the “glue” that makes up for gaps in systems within SCO. The people who have direct contact with customers and suppliers appear to be interested in working closely with them and working on improving the alignment and linkage with trading partners. On the customer-facing side, several people have alternated between working with a key customer and working at internal supply chain positions. This has given them a good view of, and appreciation for, the relationship with that key customer.

Winning Supply Chain Integration Strategy 5. A comprehensive human resource development program — encompassing hiring, career planning and training — is needed to ensure availability of the needed skill sets in integrated supply chain management.

Illustrative Practices
All five companies have developed or are developing global competency profiles for their supply chain personnel. These profiles describe the training and skills needed at all levels of the organization, from entry to executive level. To support the profiles, the companies are implementing educational and training programs to provide new and current employees with the requisite skills and education needed for success. They also are finding creative methods for delivering the training, including using asynchronous Web-based material, podcasts, and mentoring. Finally, the companies are engaging with universities, personnel firms, and other providers, to identify new and experienced people to hire. All of the firms expect a looming talent shortage as baby-boomers retire, while the need for competent supply chain managers is expanding.
Conclusions
Organizational design and structure does make a difference. Centralization can create opportunities for volume leverage and better coordination of supply chain processes organizationwide. Matrix structures help to bring functional expertise into customer-focused teams. Combining demand and supply into one organizational unit can help to resolve the competing objectives of these two groups. However, all organizational designs represent a set of trade-offs. What is gained by one design often presents new challenges in other areas.

Systems cannot fully substitute for competent, knowledgeable people making good judgments and good decisions. Systems have to be viewed as decision-support systems, not decision systems. People are needed to hold the organization together and make it work.

Section C: Metrics

Metrics can enable supply chain strategies in several ways:

1. Metrics can be used to help set the performance goals for supply chain activities and processes that are implemented to execute strategies.
2. Metrics can be used to help judge the degree to which strategies have been achieved.
3. Metrics can link supply chain strategy up and down the organization, across business units, across trading partners and to personal scorecards.
4. Metrics can help an organization learn about cause-effect relationships in the supply chain, and which strategies work and which do not.

Typically companies use a plethora of metrics to help them formulate, implement and judge the success of supply chain strategies. These metrics have common themes across organizations and functions, such as cost and quality. However, metrics often differ dramatically in how they are defined, what data is used to calculate them and how they are actually used by managers to arrive at judgments and make decisions.

Winning Supply Chain Integration Strategy 1. A balanced scorecard approach should be used for supply chain metrics.

In “Using the Balanced Scorecard as a Strategic Management System,” authors Robert S. Kaplan and David P. Norton argue that a balanced approach to metrics is needed to enable strategy. The original four categories identified by Kaplan and Norton (2007) are:

- Financial
- Customer
- Learning and Growth
- Internal Business Processes

A previous CAPS Research report on measurement and metrics for supply management (Carter 2005) modified these categories somewhat to be more specific to supply chain issues and includes:

- Financial
- Customer Satisfaction, including internal and external customers
- Innovation and Learning
- Operational Excellence, including supplier performance

Each quadrant in the balanced scorecard should identify metrics that are aligned with companywide, SBU, and functional strategies that can be connected to specific management and individual performance reports.

The challenge with implementing a supply chain balanced scorecard is that the metrics should be tied to the performance of the supply chain, not just one function or one company. An effective supply chain scorecard cannot be derived by simply grouping together functional metrics or metrics from different trading partners in the same cell. To improve the performance level of supply chain metric requires both an understanding of an extended supply chain and the ability to influence change in more than one point in the supply chain. Thus, several functions and/or companies must act in harmony to impact supply chain performance and metrics. The impact of improving the performance of only one function in one company on supply chain performance can be difficult to predict. Improvements in one area may well be detrimental to performances in another area.

For example, the number of orders delivered on time to a tier-1 customer is a function of supplier performance, factory performance, the sales/operations plan, inventory policy, forecast accuracy, and the customer’s inventory and ordering policies. At least three organizations are involved in the delivery of orders — the supplier, the buying organization and the customer. Typically no one function owns all of the company activities and processes, so functional metrics at one of
the three companies will be inadequate indicators of how to improve performance on this metric.

Although not all of the focus companies present their metrics as a balanced scorecard, they all clearly recognize the need for metrics beyond financial indicators to manage their supply chains and all have some metrics corresponding to each cell in the supply chain balanced scorecard. For example, SCO uses a balanced scorecard at the corporate level and in supply management, but does not have a separate scorecard for the supply chain. The supply management scorecard includes the following metrics:

<table>
<thead>
<tr>
<th>Financial</th>
<th>Customer Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>Internal</td>
</tr>
<tr>
<td>• Meeting the revenue forecast</td>
<td>• Number of plant shutdowns</td>
</tr>
<tr>
<td>• Revenue from suppliers based on process improvement</td>
<td>• Single source risk mitigation</td>
</tr>
<tr>
<td>• Royalty revenue from patents</td>
<td>• Internal stakeholder survey</td>
</tr>
<tr>
<td>Cost</td>
<td>• Factory quality incidents</td>
</tr>
<tr>
<td>• Cost for direct material, indirect material and capital</td>
<td>• Supplier business continuity</td>
</tr>
<tr>
<td>• Bill of material cost versus target</td>
<td>• Tool performance</td>
</tr>
<tr>
<td>• Savings on direct materials used by contract manufacturers</td>
<td>• On-time delivery</td>
</tr>
<tr>
<td>• Administrative costs per headcount</td>
<td>• Ramp up readiness</td>
</tr>
<tr>
<td>• Maverick spend</td>
<td>• % Spend with preferred suppliers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operational Excellence</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Contract price enforcement</td>
<td>New product development</td>
</tr>
<tr>
<td>• Audit results and severity of errors</td>
<td>• Performance vs. date milestones in NPI process</td>
</tr>
<tr>
<td>• Payment terms in contracts</td>
<td>• Current estimated cost against target in NPI process</td>
</tr>
<tr>
<td>• Most-favored customer clauses in contracts</td>
<td>People development</td>
</tr>
<tr>
<td>• Not-to-exceed pricing in contracts</td>
<td>• Training hours</td>
</tr>
<tr>
<td>• Keeping pricing current in ERP</td>
<td>• Leadership development pipeline</td>
</tr>
<tr>
<td>• Strategic sourcing plans in place</td>
<td>• Employee morale</td>
</tr>
</tbody>
</table>

Although well developed, the measurement system at SCO is more functionally oriented than supply chain oriented. There are only a few measures that reflect the overall success of the supply chain. The two most important metrics for supply chain were reported to be customer satisfaction and meeting the revenue forecast. However, this statement ignores the factory metric of cost efficiency, which drives much of the internal supply chain activities at SCO.

ECO did not have a formal balanced scorecard, but representative metrics can be grouped as follows.

<table>
<thead>
<tr>
<th>Financial</th>
<th>Customer Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Long-term operating cost (of the project)</td>
<td>• Cost</td>
</tr>
<tr>
<td>• Cost</td>
<td>• Performance to schedule</td>
</tr>
<tr>
<td>Operational Excellence</td>
<td>Innovation</td>
</tr>
<tr>
<td>• Performance to schedule</td>
<td>• None reported</td>
</tr>
</tbody>
</table>
ECO's metrics are well aligned with its key clients' needs. In the upstream oil and gas business segment, speed is important (project award to first barrel of oil pumped), as is reliability of performance to project schedule. Quality of design — and resulting facility operating costs — are of growing importance, and this plays to ECO's strength in working with client and suppliers early on in the design/specification phase of a project.

In recent years, the oil and gas market has moved from largely a cost-plus to a lump-sum turnkey pricing environment. This has changed the orientation of the client to be more concerned with long-term operating cost. This has tended to favor early engagement (ECO with client and ECO with key suppliers) because it facilitates better design, which results in lower long-term operating costs.

LCO does not use a formal scorecard approach, but routinely uses several metrics to help it set strategy and judge performance. LCO metrics include:

<table>
<thead>
<tr>
<th>Financial</th>
<th>Customer Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual revenue goals against goals</td>
<td>Customer satisfaction survey</td>
</tr>
<tr>
<td>Markup percentage achieved against goal</td>
<td>Guest satisfaction scores</td>
</tr>
<tr>
<td>Bonus — depends on department productivity</td>
<td></td>
</tr>
<tr>
<td>Accounts receivable aging</td>
<td></td>
</tr>
<tr>
<td>Department expense target (mostly payroll)</td>
<td></td>
</tr>
<tr>
<td>Cost reduction against goals</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operational Excellence</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity reported by project manager</td>
<td>Project survey (10-12 questions — by Web)</td>
</tr>
<tr>
<td>Cycle times</td>
<td>Sent to all properties</td>
</tr>
<tr>
<td>Time to load information</td>
<td>Most projects — one to three key client personnel</td>
</tr>
<tr>
<td>Pricing process</td>
<td></td>
</tr>
<tr>
<td>Time to reconcile project</td>
<td></td>
</tr>
<tr>
<td>Meeting completion dates (dates shift as project schedules change)</td>
<td></td>
</tr>
<tr>
<td>Number of errors in project data</td>
<td></td>
</tr>
<tr>
<td>Customer service problems</td>
<td></td>
</tr>
<tr>
<td>Project survey to property (third party)</td>
<td></td>
</tr>
<tr>
<td>Contract compliance — most important metric, but hard to gauge compliance at franchised hotels.</td>
<td></td>
</tr>
<tr>
<td>Total sales (vs. budget)</td>
<td></td>
</tr>
</tbody>
</table>

In addition to metrics for ongoing activities, LCO had metrics for major renovation and construction projects. ACO has developed and used multiple metrics for each cell of the scorecard.

<table>
<thead>
<tr>
<th>Financial</th>
<th>Customer Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current product cost</td>
<td>Customer service level or fill rate</td>
</tr>
<tr>
<td>Redesigned cost with modularity</td>
<td>Availability</td>
</tr>
<tr>
<td>Cost savings for new products</td>
<td>Special order fill rate</td>
</tr>
<tr>
<td>Year-over-year cost reduction</td>
<td>Damage returns</td>
</tr>
<tr>
<td>TCO</td>
<td>Service incident rate</td>
</tr>
<tr>
<td>Purchases on consignment ($)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operational Excellence</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste elimination through “Lean”</td>
<td>New Product Development Metrics</td>
</tr>
<tr>
<td>Cycle-time reduction</td>
<td>Part re-use/standardization</td>
</tr>
<tr>
<td>Plant utilization</td>
<td>Engineering changes</td>
</tr>
<tr>
<td>Excess transportation/expediting</td>
<td>Configurability (variety)</td>
</tr>
<tr>
<td>Inventory: raw, in-process, finished</td>
<td>High-density packages (for shipping)</td>
</tr>
<tr>
<td>Supplier/ACO plant productivity</td>
<td>Capital spend required</td>
</tr>
<tr>
<td>Customer/ACO forecast accuracy</td>
<td>Cost of quality</td>
</tr>
<tr>
<td>Supplier-held inventory</td>
<td>Material, manufacturing and logistics costs</td>
</tr>
<tr>
<td>Shortages</td>
<td>Product complexity</td>
</tr>
<tr>
<td>SKUs generating revenue/profit</td>
<td>Conversion costs</td>
</tr>
<tr>
<td>Total cost quality</td>
<td>Design change costs for modular design</td>
</tr>
</tbody>
</table>
Winning Supply Chain Integration Strategy 2.
Supply chain metrics must include external customer-centric metrics. To improve performance of customer-centric metrics, managers must understand the cause/effect relationship between process changes and outcomes. Therefore, supply chain metrics must be mapped to the processes and activities within and across functions, and across trading partners.

Satisfying the next-tier customer may be the only goal that various business functions have in common.
Satisfying the final customer may be the only goal that trading partners in a supply chain have in common.
Functional metrics will drive behavior that improves functional performance, but often at the expense of supply chain performance. Company-centric metrics can have a similar effect at the company level. Customer-centric metrics are needed to enable a customer-responsive supply chain. These metrics include quality, customer satisfaction, on-time delivery/project completion, cost and percent of orders delivered within lead times and product/service design.

All of our triads have external customer metrics in place. However, none of them had metrics that were common across the triad. Furthermore, at all of the companies there was some uncertainty about the cause/effect relationships between supply chain processes and impact on customer metrics, especially customer satisfaction.

ECO’s key customer metrics include:
• Long-term operating cost of the project
• Quality of design and execution
• Facility finished to schedule
• Safety

Once ECO is awarded a project, the key customer metrics are:
• Cost
• Performance to schedule
• Quality

ACO tracks the following customer metrics:
• Customer service level or fill rate (shipped complete/no damage)
• Availability (for customer)
• Special order fill rate
• Damage returns
• Service incident rate

LCO relies on satisfaction scores collected by their customers and by hotel guests:
• Customer satisfaction survey
• Guest satisfaction scores

SCO has several customer-centric metrics, including:
• Customer quality incidents
• Customer satisfaction
• Forecasting accuracy
• Meeting customer demand (initial demand and changed demand)
• Number of commits (customer orders) delivered on time

Winning Supply Chain Integration Strategy 3.
Selected common supply chain metrics are needed across trading partners to support supply chain integration.

For example, common measures of inventory levels across a supply chain can promote coordinated policies on where to position work-in-process and finished goods inventory, and to establish optimal levels of inventory in order to reduce waste and optimize availability for the final customer. However, none of our focus companies reported common metrics with their trading partners. There was some sharing of metrics, such as for on-hand inventory and selling rates, between two companies to facilitate forecasting, and for ordering and manufacturing scheduling. These metrics were not used in a holistic way to improve supply chain performance, but rather to improve the functional performance of the two trading partners.

Conclusions
All of the focus companies recognize the need for a good measurement system and good metrics to support their supply chain strategies. All have multiple metrics in place, especially for the measurement of the performance of functions and processes within their firm. Especially important, all of the firms have some metrics that reflect their performance with their first-tier customers. However, none of the firms have made much progress on two important fronts:

1. Building metrics that reflect the total performance of the supply chain, metrics that by definition would be cross-functional and cross-company
2. Tying customer-centric metrics back to internal and external processes that, if changed, would lead to improvement in performance (as measured by those metrics).

Firms have made much progress implementing enterprise systems and data warehouses to support their measurement systems. The next frontier is to devise and
implement new metrics that take full advantage of the new systems and newly available data.

Section D: Trust

Trust can be defined as a combination of honesty, competence, and benevolence. In this research, the issues of trust, or lack of trust, mostly revolves around competence. Examples of issues that diminish trust between the trading partners include the ability of customers to competently forecast demand, the ability of the focus companies to meet product availability commitments or project completion dates and the ability of suppliers to assess their capacity to build parts. Honesty in long-term relationships is mostly taken for granted. And all of the companies in the study clearly understand the profit motives of their trading partners.

Winning Supply Chain Integration Strategy 1. Trust is built with suppliers and customers based on the total actions of the organization and not just a supplier management or customer relationship point of view. Trust must be built at all levels of the trading partners, from executive to entry level. The executive level at a company sets the trust and commitment culture necessary for the development of trust needed at lower levels.

Illustrative Practices

LCO describes itself as a “not-for-profit” business that buys for and sells to hotel properties. (However, LCO returns a “dividend” each year to its parent organization.) This helps generate trust with suppliers and customers as most competing buying organizations are for-profit. LCO is transparent with customers regarding charges, the best price/quality decisions for new construction/renovation, and mark-up of goods and services. It sees itself as credible and honest, and works hard to keep its schedule and cost commitments. LCO builds trust with its suppliers by giving them generous financial terms and conditions. For example, LCO will pay the supplier if a hotel defaults on payments and then work with the property owner to secure payment.

Trust about demand forecasts, commitments and any form of risk/reward sharing is generally low between ACO and its customers. In particular, it appears that the forecast system between ACO and a key big-box customer is “broken,” generating low trust in the products forecasts.

When suppliers get the idea that they and ECO are “in this together,” they are more willing to act for mutual benefit. In one instance, ECO made a pre-commitment of business to get a supplier to develop a new capability to build coke drums. The pre-commitment was necessary to convince the supplier to make the necessary capital investment. Developing this supplier allowed ECO to deliver in 15 months versus 22 months for its competitors.

Trust can vary at different levels of the relationship. There is a trusting relationship, for example, between SCO and the supply management people at a key customer, but trust at higher levels between SCO and this customer appears to be under some strain.

Winning Supply Chain Integration Strategy 2. Trust is a two-way street. Efforts at building trust by the focus company must be reciprocated by the trading partner for the efforts to bear fruit.

SCO strives to have a trusting relationship with all of its major customers. Many customers trust SCO, want to partner with it, and do not try to “game” SCO systems. SCO works with these customers on a collaborative basis. In contrast, other customers want to battle on prices, terms and conditions, give only short-term forecasts and withhold information that would be useful to SCO. The trust level with these latter customers is low.

SCO tries to provide customers with incentives to be more trusting and collaborative. These incentives have included the opportunity to cancel orders on a short lead-time basis and holding consignment inventory in a third-party distribution center.

Winning Supply Chain Integration Strategy 3. Trust in internal relationships is also important. New organizational designs and relationships can help build trust internally.

To resolve internal conflict, SCO merged its supply-side and demand-side planning organizations into a Supply Demand Operations (SDO) team to improve collaboration and trust on goals and broader appreciation for total business. There is now more trust across groups within SCO, but each group still is held accountable for making its own numbers. The SDO is led by two people both reporting to the senior vice president of sales and marketing.

At ACO, very limited trust exists between different groups that are assigning priorities to “their” customers. This ability to modify priorities in the ACO system was only alleviated by establishing a central group representing different functions (demand planning, marketing, supply chain, etc.), getting customer demand on Friday and meeting and setting customer priorities on Monday — by brand, market, channel and product. The “system” is “locked” to others.
Product design collaboration is driven by ACO, building trust between product design and the supply chain — with customer, product design, suppliers, logistics, manufacturing and trading partner interdependence. One overarching objective of product design collaboration is to get product designers, manufacturers, engineers and suppliers together prior to final design to achieve labor and capital savings upfront.

**Winning Supply Chain Integration Strategy 4.** Complex business relationships can make building trusting relationships more difficult.

SCO outsources assembly/test work while retaining some of the same work inside. This makes SCO a supplier, a customer and a competitor to its assembly/test subcontractors. This complex relationship presents special challenges in supply chain alignment. A close alignment as customer and supplier can be challenged by the competition between both firms, diminishing both information sharing and trust. Special processes are needed to parse the information that passes to the supplier from that which must be protected from the competitor. It is doubtful that a fully open and trusting relationship can be established in this situation.

**Winning Supply Chain Integration Strategy 5.** Relationship longevity and experience have a major impact on trust.

ECO has had an alliance-type relationship with a key supplier since 1993. This is the company's oldest, most successful and most utilized alliance. Key to the success of this relationship, beyond the supplier's competitive quality and pricing, is its ability and willingness to work on a collaborative basis with ECO. ECO is comfortable working closely with the supplier because it trusts its supplier not to be opportunistic and take unfair advantage.

ACO has a customer that has been a key account for many years. ACO trusts this customer to live up to its demand forecast and helps absorb demand uncertainty in the marketplace.

**Conclusions**

Long-term relationships are characterized by high levels of trust. The cause and effect are not always clear, but what is clear is that companies have little time or desire to work with customers or suppliers they cannot trust. This does not mean they always agree or always have compatible goals. It does mean that can count on their trading partners to behave honestly and keep their commitments if at all possible and, if not possible, to give advance notice and to have a good reason. Strategic partnerships are always characterized by high levels of trust at all levels of the organizations. Trading partners who do not trust one another seldom do business for very long and, if forced by circumstance to conduct business transactions, do so at arm's length with a “market-based” relationship.

**Section E: The Impact of Enablers on Strategy and Processes**

Figure 17 illustrates the impact of enablers on strategy and processes. The heavy lines indicate areas of high impact, while the lighter lines indicate areas of lesser impact. For example, “trust” influences all aspects of business and supply chains to some extent and the line indicates this. However, with respect to supply chain integration, trust has the most impact on supply chain processes. Metrics, however, strongly influence all three segments.

**The Impact of Metrics on Strategy and Processes**

Strategies are maintained, fine-tuned or radically changed based on conditions and outcomes as indicated by metrics. Thus it is essential that valid/accurate metrics — the metrics measure what we think they measure — and reliable/precise metrics — the metrics consistently give the same answer when conditions are the same — be employed for shaping and changing strategy. Otherwise, strategies will be implemented that have little or no connection to actual conditions and will succeed only by chance. For example, wrong metrics about customer satisfaction can lead to poor strategic choices about product/service designs. Wrong metrics about stock outs at major retailers can lead to wrong decisions about supply chain designs.

As metrics reveal the success or failure of strategies, they in turn give guidance on priorities for future strategic actions. Thus, metrics might suggest the need for more marketing effort in a particular region, the need to develop new or refresh old products, the need for more (or less) inventory at specific points in the supply chain, and so forth.

Processes are instituted in organizations to consistently and correctly execute strategy. Even when strategies change, the basic processes stay in place. For example, processes for replenishing supplies at a customer location will continue, even thought strategies about service levels may change. Processes rely on performance measures in feedback loops for making changes to inputs or process parameters, as illustrated in Figure 18.

Unreliable or invalid measures or the lack of measures will lead to incorrect process adjustments. For example,
wrong metrics about service levels in the supply chain can lead to wrong decisions in the Sales and Operations Planning process that allocates scarce capacity to product lines.

Impact of Trust on Supply Chain Strategy and Processes
If trading partners do not trust each other, their strategies will not be aligned to the maximum extent possible. For example, if a supplier does not trust a customer to not backward integrate into its business, then the supplier will be hesitant to make new investments in plant and equipment that might benefit the customer. If a company cannot trust a customer to give it reliable indicators of its future business direction, the company will be reluctant to make changes to products that could benefit the customer.

Figure 17
Enabler Impacts on Strategies and Processes

Figure 18
Feedback Loop — Performance Measures
Trust between trading partners is especially important at the level of operational processes. For example, if a company cannot trust a supplier to meet its order fulfillment promises, the customer may over-order a product to help ensure that it will receive sufficient material to keep its plants running properly. If many customers do this, the supplier will get a false reading on total demand. In fact the demand may look like it widely exceeds the capacity of the supplier, setting up perhaps a situation where the supplier intentionally ships short because of its presumed inability to meet demand. If the supplier does meet its commitment, then the buying company will end up canceling or postponing orders, further harming the supplier’s business. Thus, a lack of trust can set up a sequence of events that harms both the buying and selling company.

Impact of Organization and People on Strategy and Processes
Organizational structure is strategy translated into roles, responsibilities and relationships. Organizational structure should directly reflect strategy. An organizational structure that is at odds with strategy, such as a cost-driven supply chain organization in a customer service-driven industry, will be a serious impediment to the success of the strategy. Large organizations have complex structures. Often matrix relationships and multifunctional teams are in place to ensure that a multitude of ideas, information and objectives are fully considered before action is taken. Furthermore, organizational structure must reflect the complexity of markets where companies and their customers/suppliers can simultaneously be partners, competitors and suppliers/customers. Only organizations that are thoughtfully structured can be responsive to complex and rapidly changing business environments.

Many supply processes cross traditional functional organization boundaries. For example, sourcing teams must be cross-functional to include the many demands that will be made of suppliers. And, Sales and Operations Planning needs input from supply management, manufacturing and sales/marketing to make informed decisions. Organizational structure must be able to easily accommodate and facilitate these cross-functional needs without the need to construct elaborate exception plans and negotiate ad-hoc agreements. Likewise, budgets are often closely tied to organizational structure and must accommodate the cross-functional work of supply chain processes.

Without doubt, skilled, intelligent and capable people are the energy source that powers all organizations. The most brilliant strategy coupled with the most creative organizational structure will fail without the right people to fill the roles and execute the strategy. Supply chain professionals need a global outlook, a good understanding of company and supply chain strategy, and detailed knowledge of the supply chain processes. They should also be agents of change, ready to change processes and strategies as needed to meet the challenges of a dynamic and complex business environment.

Impact of Communication on Strategy and Processes
Companies have formalized channels of communications that enable strategic alignment and cross-functional and cross-company processes. Frequent and regular communications among functions that make up the internal supply chain are essential for the execution of strategy. Furthermore, communications must flow from inside the organization to the supply network, to customers, to contract manufacturers, to logistics suppliers and to business units with profit and loss responsibilities. People-to-people communication, formal and informal, is needed to formulate and execute strategy. A continual two-way exchange of information is needed on business trends, future business prospects, technology roadmaps and so forth. At the supply chain process level, formal and informal communication is needed to keep processes operating at expected levels of performance. This is complemented by communications that address problems that pop up, to share new information and generally to facilitate joint action among trading partners.
In this chapter, we provide an expanded discussion of the challenges to achieving supply chain integration identified in Chapter 2. Each of these challenges is based on our interviews, and is consistent across the firms visited. These challenges are truly impediments that must be overcome if a firm is to be successful in integrating its supply chains. We also provide the reader with a “strategic direction” for each challenge based on our research. The purpose of the strategic direction discussion is to help drive improvement in supply chain integration.

However, it should be recognized that the strategic directions will require adaptation by each company. In addition, achieving supply chain integration will be a long and complex journey, requiring a constant focus and measurable success along the way.

Challenges to Supply Chain Integration and Strategic Directions

Based on the case studies completed as part of this project, we conclude that the ideal integrated supply chain is far from a reality at this time. There are certainly many success stories and many pockets of excellence where portions of some supply chains are being effectively integrated. There are also, however, many stories of failures and breakdowns in integration — due to a variety of causes. Through our research, we have identified the following 14 key challenges organizations face in attempting to achieve supply chain integration.

1. Establish a vision of how financial and non-financial results will improve with supply chain integration.

   The visibility of supply chain management has increased in recent years, but there is still not a clear and holistic vision in many organizations of how supply chain management will contribute to the success of the organization, beyond simple cost reduction. Without a holistic vision, supply chain alignment and linkage are impossible to achieve.

   **Strategic Direction**

   Firms in the research are expanding their vision of the supply chain beyond functional boundaries. There is increasing focus on collaboration among functions and with customers and suppliers even beyond the first tier. Increasing attention is being placed on how increased alignment with key customers and suppliers can improve financial performance. There is also a broadening view of what the supply chain includes.

   The firms included in the research are also expanding their view of cost from a narrow perspective to a total supply chain cost and investment perspective. Decisions are being made that take all cost elements into account. For example, global sourcing decisions include price, transportation, inventory, currency exchange and risk considerations. The companies reported positive benefits gained from improved supply chain integration.

   However, functional barriers still exist and there is a need to create a truly global and holistic supply chain vision driving behaviors companywide. In addition, the linkage between supply chain integration and financial improvement needs to be better understood and documented.

2. Develop people, culture and an organization that supports the supply chain vision.

   Organizations have many people with perspectives and capabilities based on years of functional experiences. Few people, however, understand and drive toward overall supply chain objectives. Traditional barriers between functions within and across organizations continue to inhibit communication and goal alignment.
among internal and external stakeholders. A focus on functional goals, objectives and metrics limits supply chain alignment and linkage.

**Strategic Direction**

The most important organization decision for supply chain integration is to have a “C-level” executive leading the supply chain organization. This gives the supply chain organization a voice in setting strategy for the enterprise, provides the organization clout to drive integration across internal units and provides a clear message to suppliers and customers that integration is important.

There are many options for organizing the supply chain, all of which bring certain benefits and challenges. Mostly the structure will reflect the business model of the CEO and other executives. Whatever the organizational structure, supply chain integration can be fostered by the liberal use of cross-functional teams, by designing processes that cross organizational boundaries, and by ubiquitous enterprise information systems.

A comprehensive human resource development program — encompassing hiring, career planning and training — is needed to ensure availability of the needed skill sets to manage the integrated supply chain. This must be done in conjunction with the human resources department. People must be found at all levels who can understand the supply chain beyond their functional role. This is enhanced by rotating high-potential people through many functions and locations within the organization.

3. **Develop customer-centric metrics.**

Metrics and measures drive behavior. Many existing metrics focus on functional goals and short-term financial performance. The use of metrics that are focused on the needs of key customers will help focus the performance of the extended supply chain members on serving the final customer. This, by necessity, will drive alignment and linkage.

**Strategic Direction**

Companies must first decide on their competitive priorities for winning business with customers and consumers. These priorities will usually include some order qualifiers, such as high quality, and order winners, such as technological improvement. From this determination, the next step is to design metrics that measure, as closely and completely as possible, each of the priorities. For example, if quality is a competitive priority, then the company must determine what dimensions of quality, e.g. fit and finish, reliable performance, ease of use, and so forth matter most to customers. Some priorities may be ill-specified.

Therefore it’s challenging to construct appropriate metrics. For example, some consumers are interested in buying products that are “green,” but “green” is a description that means different things to different people. Therefore, consumer research will be needed to determine the alternative dimensions of green and how each might be measured. Even after this work, appropriate measures of key attributes may be difficult to design.

Once appropriate measures have been defined, the next difficult task is to tie the measures back to specific supply chain processes that impact the measures. It may be relatively straightforward to trace some quality metrics back to specific manufacturing processes. Other measures, on the other hand, may be impacted by several supply chain processes. For example, on-time delivery may depend on supply-facing processes such as supplier capacity forecasting, internal processes such as SOP, and customer-facing processes such as logistics systems. All of these processes might have to be improved to generate an improvement in the on-time delivery measure.

Consumer-centric metrics should become part of a scorecard-based approach to performance measurement. Each quadrant in the balanced scorecard should identify metrics that are aligned with companywide, SBU, and/or functional strategies that can be connected to specific management and individual performance reports.

The challenge with implementing a supply chain-balanced scorecard is that the metrics should be tied to the performance of the supply chain, not just one function or one company. To improve the performance level of supply chain metric requires both an understanding of an extended supply chain and the ability to influence change in more than one point in the supply chain. Thus, several functions and/or companies must act in harmony to impact supply chain performance and metrics.

4. **Develop multiple supply chains to meet various customer market segment needs for company products or services.**

Companies with multiple customer/market segments cannot operate at optimal performance with only one supply chain. Each segment will have different needs, such as cost, speed, flexibility, and technology that require supply chains with different capabilities and cost structures to meet those needs. The multiple supply chains will require different levels of alignment and linkage to achieve desired performance levels.
Firms are starting to more carefully define the various customer and market segments that they sell to and determine the competitive characteristics of each segment. For example, big box retailers have different needs than construction trade partners and therefore require different supply chains. Because there is no such thing as an average customer, even within a major segment, supply chains are being fine-tuned to meet specific customer needs. Furthermore, markets in developing economies demand cost performance at levels unheard of in developed economies. Our research companies are designing whole new supply chains, largely based in the developing economies, to supply the local markets.

5. Establish the correct positioning of work worldwide.
Through effective insourcing/outsourcing combined with global sourcing, firms need to establish where in the extended supply chains work should be done to best provide the highest possible total value to the customer. Without this positioning, work may be done at inappropriate geographical or cost locations, limiting overall supply chain performance.

Insourcing/outsourcing strategies are becoming more robust as purchasing/supply is being asked to find the best suppliers worldwide for lines of business, products, services and processes. Work is being located based on internal and external supplier capabilities, total cost, geography and ability to support customer requirements. The view at these and other companies is becoming longer-term, looking out three to five years or even longer.

At the firms in our research, the outsourcing of all categories of work has increased and may increase further. In addition to conducting a full analysis at a point-in-time, the insourcing/outsourcing strategies are being reviewed regularly to ensure that work continues to be correctly sourced.

6. Incorporate supply chain ramifications into product and service design decisions.
Product and service design should consider the impact of design on operations, sourcing, unit price, packaging, logistical costs, and flexibility and responsiveness. Myopic product and service designs introduce considerable complexity, waste and inflexibility into supply chains, and create alignment and linkage barriers.

Design for supply chain, including collaboration across functions and enterprises early in the product/service development process is slowly gaining recognition, acceptance and implementation. Cost, innovation and supply chain performance are being improved.

To some degree, all firms in the research were including suppliers in the process of establishing new product/service designs and specifications. There were initial efforts to develop product and service designs that took into account the impact on total supply chain costs. For example, one firm establishes the logistics cost reduction could be achieved by modifying product configuration. Other firms determine how much inventory cost and complexity can be reduced if standardization of components is achieved. Our engineering-construction company estimates the reduction in project time that can be achieved if suppliers and customers work together to specify and plan for the project.

There are also numerous reports of successful design for supply chain in the business literature. Competitive pressure will only increase the focus on implementation of the “design for supply chain” approach.

7. Maintain sourcing as a first-level priority.
Choosing, developing and leading suppliers in a supply network are critical to supply chain success. Without fully capitalizing on the capabilities of suppliers throughout the extended supply chain, competitive opportunities are lost. Without a strategic supply management focus, alignment and linkage are impossible.

As outsourcing has increased over the past decade, reliance on suppliers as an integral part of the supply chain has become more important to meeting customer requirements. Frequently, the supplier network is or may be the most critical element of the supply chain as evidenced in the appliance, computer and electronic industries.

Businesses are in a constant state of flux — people come and go, businesses are acquired and divested, profits rise and fall. The time needed to create a truly
integrated supply chain may exceed the “attention span” of the trading partners. The challenge from a supply chain perspective is to maintain, through all of the turbulence and change, the relationships and the strategies with key customers and suppliers that build supply chain alignment and linkage.

**Strategic Direction**

In the five focus companies, both customer and supplier relationships are viewed as critical to achieving high levels of supply chain performance and integration. Approaches to building and maintaining relationships with suppliers included supplier segmentation to focus business opportunities; sharing of business and technology roadmaps and expanding collaborative efforts; internal and external recognition programs; and executive-to-executive relationship building.

From the customer perspective, all of the firms are carefully listening to the “voice of the customer.” Collaboration with customers is most evident in determining product or service design, specifications or performance requirements by direct personal interfaces with customers. In addition, all of the firms maintain direct supply chain connections with customers to determine forecast and actual demand requirements over time. Critical to success is the ongoing personal contact with customers, supported by information systems providing “hard” information.

Consistent decisions and the logic for the decisions, when communicated effectively to customers and suppliers, also appear critical to maintaining strong working relationships over time. Communications can be improved by having a “point person” at the executive level for both important customers and suppliers. There may also be functional contact persons in place across supply chain activities between organizations. Consistency in working relationships also requires a culture that views both suppliers and customers as important to long-term success with trust and equity in the business relationship.

**9. Create an effective sales and operations planning process (SOP).**

The SOP process is at the heart of supply chain linkages. Done well, it creates the appropriate customer-driven balance between supply and demand, and establishes appropriate priorities. Effective SOP is also essential for supply chain alignment.

**Strategic Direction**

SOP should be a strategic process that enables executives to reach consensus on a single operating plan that allocates critical resources to reach corporate performance targets. The SOP should set the overall level of manufacturing output (production plan) and supply plan to best satisfy the planned levels of sales (forecasts), while meeting the business objectives of profitability, productivity, competitive customer lead times and customer priorities. SOP is the process where many trade-offs are resolved and the execution of resulting decisions are started.

Ideally sales and operations planning will include all lines of business and brands, all factories and regional operational facilities, and all strategic supply sources, including contract manufacturers.

The SOP process should be supported by access to all of the data needed to make these important decisions, including the capacity, loads and lead-time for internal factories, suppliers and contract manufacturers. From the sell side, the SOP needs well-developed forecasts, actual orders and customer priorities. In addition, the SOP should be supported by decision support tools to test a multitude of planning scenarios before a final course of action is selected.

**10. Develop effective databases, data and information.**

Ironically, organizations are awash in data but lack needed visibility up and down the supply chain. For example, inventory levels of critical materials at suppliers and finished goods at customers are often unknown. Moreover, the quality of internal data is often questionable. This lack of complete, valid and correct data inhibits supply chain integration.

**Strategic Direction**

Companies have been and continue to work diligently on extending the functionality of their ERP systems to support and integrate their supply chains. Two strategies are developing for large organizations. The first is to have one instance of their ERP system with databases fully rationalized and accessible across the organization. The second approach is to have several, even many, instances of various ERP systems, supported by data warehouses that rationalize data through the use of the translation tables.

More difficult is seamlessly connecting information systems among companies. Many companies are using supply and customer portals to bridge the gap in the short run. More promising in the longer run is the use of XML-based templates to exchange information between trading partners. The electronics industry is pursuing this approach using RosettaNet for tactical transactions. Systems for the seamless exchange of strategic information and data are still in the future.
11. Develop the capabilities and analytic tools required to make effective decisions in an increasingly complex and risky environment.

Today’s supply chains are characterized by extended supply lines with complex trade-offs, obtuse costs and increasing risks. Multidimensional (including prices, inventory levels, risk, total supply chain costs, sustainability, etc.) decision-models are required to help evaluate opportunities and risks across multiple global supply chains. Decisions that more fully reflect all of the relevant dimensions are required for supply chain alignment.

Strategic Direction
Companies are taking the first step in developing this capability by building robust systems to provide the necessary data to support complex models. However, the model development is lagging. Today, much of the analysis is conducted using ad-hoc spreadsheet models, that are often incomplete and in some cases improperly constructed. Even if correct, these models may be understood only by the developer or a small analysis group.

Encouragingly, companies are enlarging their capacity for using large-scale modeling and optimization techniques that have been under development for several years. These models combine the use of high speed computers with large amounts of memories, sophisticated software for solving the models, and user friendly fronts ends for enter data and report generators. Most importantly, new alliances between supply chain managers (who understand the problems and need the models) and technically skilled people (who can build the models and run the software) are being forged. These alliances are providing guidance and solutions to many of the complex supply chain issues highlighted in this report.

12. Build trust within and across organizations in the supply chain.

Trust is essential for supply chain alignment and at the heart of sharing information and working collaboratively toward common goals. One feature of effective supply chain integration is reaching a point where a function or an organization can make or agree to a decision that does not maximize its short term gain but will be in the best long-term interest of the extended supply chain. The organization needs to trust that, with the collaboration of its trading partners, all will benefit in the long term.

Strategic Direction
Companies are realizing that as supply chain complexity is increasing supply chain, all of the risk cannot be mediated by contract language or by insurance.

Companies, by necessity, must become more trusting of their trading partners if supply chain performance is to improve. Companies are both trying to be consistent and honest in their behavior, essential to the foundation of trust. They are also trying to demonstrate their competence by always living up to their promises, another essential element of trust. At the same time companies are naive in their behavior and are sharpening their abilities to assess risk, including the risk of trusting a trading partner. Companies are building long-term relationships and many points of contact between their trading partners to foster trust and to lessen the risk of relying on that trust.

13. Find ways to share risk equitably among supply chain members.

A key part of creating the trust that is necessary to enable organizations to work collaboratively is the understanding that supply chain partners will equitably share risks. For example some supply chains, due to the nature of the markets they serve, must cope with high levels of uncertainty about levels and timing of customer demand. This creates the temptation to push the responsibility for absorbing the costs of this uncertainty, either through inventories or excess capacity, off onto supply chain partners with less power. However, opportunistically pushing risk off onto supply chain partners undermines alignment (and trust) in the supply chain.

Strategic Direction
Companies are adopting risk assessment techniques that go beyond the common “red-yellow-green” models. Working with their trading partners, they are carefully assessing the risk in the supply chain several tiers into the supply base and several tiers into the customer base, perhaps even to the final consumer. They are building sophisticated simulation models to help answer “what-if?” questions and gauge the impact and risk of various events in the environment. They are also learning from past experiences (e.g. hurricane Katrina) and putting into place, in conjunction with their trading partners, comprehensive contingency plans for the supply chain.

14. Find ways to share rewards equitably among supply chain members.

Rewards are more easily shared when revenues and profits are growing. When business is slow or declining, powerful members of the supply chain may take opportunistic action to shore up their performance at the expense of their trading partners. All members of the supply chain must keep the overall goals of the supply chain in mind and consider an equitable distribution of rewards in good times and bad. Supply chain alignment is more about growing the “pie” rather than deciding how the “pie” will be divided.
Strategic Direction
With the growth of outsourcing and contract manufacturing companies have become more dependent on their extended supply bases. The business failure of a key supplier or contract manufacturer can wreak havoc on the business and maybe even the industry. Therefore companies are looking carefully at the margins of their trading partners to help ensure that the key players in the supply chain will be financially viable into the future. Furthermore, companies are increasingly looking to their supply base for product and service innovations that will keep the supply chain competitive. Companies are realizing that to keep the innovations flowing, the innovating firms must be adequately rewarded for their ideas. Firms are developing new approaches to funding new innovation in the supply base, managing the resulting intellectual property and sharing the revenue streams that result from introducing the new ideas to the market place.

Conclusions
Successfully meeting these 14 challenges requires a strategic approach with a clear view of projected rewards and required resources. Overcoming these challenges will require changes in the culture of some firms and the fundamental way in which they have operated. Equitably sharing risk and rewards, trusting suppliers and customers, and collaborating beyond tier-1 trading partners will be radical changes for some companies. Nonetheless, the rewards from integrating the supply chain are obvious and attractive. Most firms can benefits from adopting strategies, polices and processes that facilitate closer integration with their trading partners.
In earlier chapters, supply chain strategies and processes that are essential for supply chain integration were discussed in detail. This chapter focuses on the specific role and contributions of supply management to supply chain integration.

**Supply’s Overarching Role**

The overarching role of supply management within an integrated supply chain is to increase the value contribution from the supply base, helping to ensure that the firm’s profit, return-on-investment, market share and volume levels targets are met. To maximize their value contribution, suppliers can play a role in new product/service development, customer-order fulfillment and frequently, post-sales service.

**Supply Leadership’s Contributing Role**

Supply leaders must ensure effective global supply base management to meet their firm’s needs. The ability to influence, lead and manage a globally dispersed supply base to acquire needed goods, services and technology, combined with speed and cost advantages, can contribute to a company’s overall competitive advantage. Supply management also contributes by finding and working with the best suppliers to add value in the following ways:

- Design and develop new, innovative products and services. This requires supply management to share overall business, product/service and technology roadmaps. A particular focus is to work with suppliers to reduce non-value-adding product/service complexity, while increasing standardization and incorporating design for supply chain approaches. Simplification can improve supply chain alignment and linkage, and reduce the risk of supply chain disruption.
- Help achieve effective and efficient tier one customer-order fulfillment. Clearly, suppliers must be flexible and responsive to difficult to forecast and changing tier one customer needs. This can be best achieved when supply leaders clearly communicate with suppliers at all organizational levels and facilitate cross-functional and cross-enterprise information sharing about schedule priorities; flexibility and responsiveness requirements;
- Be committed to providing continuous and breakthrough performance improvement. This requires the focus company to also value performance improvement and be prepared to listen and react to improvement ideas from suppliers. The focus firm may also have to provide resources and improvement processes (e.g. six sigma teams) to suppliers.

**Supply’s Value-Add to Integrated Supply Chains**

Supply management plays an important role in the achievement of aligned and linked supply chains and can add value in multiple ways. Supply management can be a leader, major participant or information provider/facilitator in supply chain strategies and processes. Figure 19 illustrates our conclusions about supply management’s value-adding roles and relationships in integrating the supply chain.

The following discussion elaborates on the leadership role of supply management in integrating the supply chain.
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<tr>
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<th>Leader</th>
<th>Major Participant</th>
<th>Information Provider/Facilitator</th>
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</thead>
<tbody>
<tr>
<td><strong>Strategic Vision</strong></td>
<td>Develops vision of strategic supplier roles and how suppliers will add value</td>
<td>Creates overall supply chain strategy</td>
<td>Global supply network capability and capacity</td>
</tr>
<tr>
<td><strong>Insourcing/Outsourcing</strong></td>
<td>Key role in insourcing/outsourcing decisions Hands responsibility and development to suppliers</td>
<td>Develops detailed supplier capability information</td>
<td>Provides logistical cost information</td>
</tr>
<tr>
<td><strong>Segmentation and Architecture</strong></td>
<td>Establishes worldwide supplier footprint</td>
<td>Develops supplier capabilities to meet segmented customer needs locally, regionally and worldwide</td>
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<tr>
<td><strong>Product/Service Design</strong></td>
<td>Worldwide scouting for new innovative suppliers</td>
<td>Engages suppliers early in new product/service design Works with technical community to establish supplier capability to innovate, develop and launch new products/services Product complexity reduction</td>
<td>Provides complete supplier capability assessments Balances cost vs. innovation focus</td>
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</table>

<table>
<thead>
<tr>
<th>Supply Chain Processes</th>
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<tr>
<td><strong>Supply-Facing Process</strong></td>
<td>Establishes a global supply base Develops and implements global sourcing strategies and processes Supplier performance measurement and development</td>
<td>Cross-functional team participation in developing overall supply chain strategy</td>
<td>Complete surveillance of cost, availability, quality and possible industry innovations</td>
</tr>
<tr>
<td><strong>Customer-Facing Process</strong></td>
<td>Engages key strategic suppliers with customers when appropriate</td>
<td></td>
<td>Provides information about supply constraints, and current and future purchase price trends</td>
</tr>
<tr>
<td><strong>Sales and Operations Planning Process</strong></td>
<td>Major participant in providing information and achieving supply/demand balance</td>
<td>Information about supplier capability to respond to supply and demand changes, and influence supplier allocations</td>
<td></td>
</tr>
</tbody>
</table>
**Strategic Vision**

Supply management is a leader in establishing the supply chain vision in three of the participating focus companies. In these companies supply management communicated the key role of strategic suppliers in the competitive success of the focus company. This includes identifying the different roles that strategic suppliers can play — from high-technology innovator to low-cost producer. In the other two companies, supply management was a major participant in establishing the vision. In all five companies, supply management provides critical supply base information, including worldwide supplier capabilities and price/cost trends.

For example, as CCO increased its outsourcing, it was critical that supply management establish the vision for how CCO would focus on one supplier for critical innovations and work closely with that supplier to develop new products. A change in the traditional “arm’s-length” approach would be required, increasing the need for information sharing about technology, product, schedule and business plans.

**Insourcing/Outsourcing**

In all of the participating companies, the primary role of supply management in insourcing/outsourcing is as a major participant and information provider. Supply management is part of the insourcing/outsourcing strategy decision team and the provider of external supplier costs and capabilities.

At ACO, the global procurement leader plays a key strategy role in determining the specific insourcing/outsourcing strategy. He also helps determine the characteristics of the core components and manufacturing processes and leads the global outsourcing of the non-core items and processes.

**Segmentation and Architecture**

All of the focus firms in the research are developing their supply chains to support expanding markets in Asia-Pacific and Latin America, and supply management is a leader in the design decisions. Supply management takes the lead in critical decisions affecting the geographic spread of the supply base and how to fully leverage the scale of the buying firm. In addition, supply management takes the lead in developing the future supply base required to meet future customer needs in all economic regions in which the company will be selling.

For example CCO had to choose between one large plant with significant economies of scale versus several smaller plants closer to regional markets. Capital investment, transportation costs, customer service and global supplier footprint were all critical considerations in the decision.

**Product/Service Design**

In all of the focus companies supply management is a major participant in product/service design. They work with suppliers to help establish designs that use standard items, are easily manufactured and can be shipped effectively and at low cost. These efforts include focus on weight reduction, parts elimination and re-use, material substitution, and packaging designs to reduce logistical costs and facilitate customs inspections. In addition, supply management has a commercial focus in new product/service design and development and is engaged in finding new suppliers and/or evaluating supplier capabilities. Supply management is closely involved in establishing non-disclosure agreements and negotiating development contracts, exclusivity and follow-on production contracts.

At LCO supply management took the lead in finding suppliers to provide new designs for a major overhaul of a hotel chain. Once designs were agreed to by the stakeholders, supply management incorporated the activities of the suppliers of the winning designs into the overall project plan for the remodeling.

**Supply-Facing Processes**

At all of the focus companies, supply management’s most critical leadership role is in supply-facing processes. Supply management clearly leads all aspects of strategic sourcing on a global basis, including sourcing, contracting, supplier collaboration efforts for productivity improvement, product/service development and supplier development. Supply management also plays a key leadership role in product and process value analysis/engineering efforts, supplier managed inventories, payment terms, and supplier responsiveness and flexibility.

Increasingly, supply management is leading and managing a supply base spread across the globe. It plays an integral role in ensuring that suppliers — today and in the future — can meet the needs of customers worldwide. Supply’s role in the focus companies was expanding to include a greater focus on innovation and collaboration. Some examples are:
• Increased focus on innovation from suppliers and global coordination of the supply network on a center-led basis at a CCO
• Innovation and supplier contribution to product design innovation to achieve supply chain efficiency at ACO
• New product/service development with supplier collaboration for innovative solutions at LCO
• Customer, buying company and supplier collaboration to achieve project ROI targets at ECO
• Sharing and implementing new technology with suppliers at SCO

Overall, supply’s role in improving supply chain performance, from new product/service development through customer-order fulfillment is increasing. This is due to the added importance of suppliers in providing low cost manufacturing and service, innovation, and expertise in meeting global customer demand.

Customer-Facing Processes

Supply management’s role in supply-facing processes at the focus companies is to provide information about supplier capabilities and constraints to internal customers. However, in the project work at ECO and LCO, supply management regularly provided this information to customers and in doing so became part of the project team. Suppliers also became engaged directly with customers regarding needs and business plans.

Sales and Operations Planning Processes

At all of the focus companies the primary role of supply management in the Sales and Operation Planning process is to provide information about supplier capacity and load. In time of short supply, management also has an important role in influencing supplier allocation decisions. In addition, supply participates in the SOP process by providing insight into future supply market and supplier capacities, enabling the development of longer-term strategies to balance supply and demand.

Conclusions

Supply leaders must champion the vision of integrated supply chains and the functional role of supply within that vision. Specifically supply management must develop sourcing strategies, metrics, information transparency and collaboration approaches that support supply chain alignment and linkages. Overall, supply has an increasingly important role to play in achieving customer-centric supply chain integration and improve supply chain and firm competitiveness.
Integrating a supply chain is a long and complex transformation process. Integration must be viewed as a journey, and broken into manageable objectives and tasks without losing sight of the overall direction and goal. To achieve integration, companies must first address difficult issues in their internal supply chain. Then they must reconcile and rationalize their internal supply chain with those of customers and suppliers, whose goals and objectives may be significantly different. Although this report focuses on supply chain triads, analogous to three links in a chain, in reality companies operate in a network, not a chain. Thus supply chain integration must achieve alignment and linkage with multiple customers and multiple suppliers simultaneously. Making and sustaining progress in such complex environments takes vision, dedication and persistence. Unfortunately in some cases, hard-gained ground is lost as company leadership, key customers, key suppliers, key competitors and technologies change.

By closely examining the complexities of multiple supply chains across multiple industries, we have identified some successful strategies, processes and enablers that will help companies improve their supply chain integration internally and externally with their trading partners. The supply chain vision, strategies, processes and enablers are summarized in this chapter.

**Supply Chain Vision**

The first step on the road to integration is the establishment of an appropriate strategic vision for the company’s supply chain. The supply chain vision should encompass the elements needed for the company to achieve high performance, as indicated by key customer-centric metrics. The supply chain vision must address:

1. Customer/market segmentation and service level strategies
2. Product/service design decisions
3. Reduction of product complexity
4. The global manufacturing footprint
5. Outsourcing strategies
6. The global supply base
7. Information transparency across trading partners
8. The sales and operations planning process
9. Customer-driven metrics that are linked to firm performance
10. The need for highly capable people.

Today many organizations have only a limited supply chain vision. For example, they define their supply chain as the external supply network or as new product/service development or as customer-order fulfillment processes or the internal supply chain. Other firms focus only on functional performance goals, such as factory costs, service quality or customer delivery. Unfortunately, a partial supply chain vision or a narrow focus on functional excellence will not result in the highest levels of supply chain integration and company performance. Maximum company performance rests on a foundation of a well-integrated supply chain. After establishing a vision, further progress on the integration journey includes implementing supply chain strategies, processes and enablers. Following are some maxims of supply chain integration derived from our research.

**Supply Chain Strategies**

**Insourcing/Outsourcing**

1. Supply chain integration is enhanced by systematic and cross functional insourcing/outsourcing decisions that support the company’s business model on a global basis.
2. Supply chain integration is enhanced by sharing product/process technologies with key suppliers.

Supply Chain Segmentation and Architecture
1. Supply chain integration is enhanced by segmentation of the customer base and/or markets based on volume, variety, profitability, and customer requirements. Supply chain design should be tailored to the different customer segments, while supply chain processes should be standardized.

2. Supply chain integration is enhanced by segmentation of the supply network based on criticality of suppliers and/or the commodities they supply. The most important supplier should have the highest degree of supply chain integration.

3. Supply chain integration is enhanced by supply base consolidation, overall, or by geography or by market.

Product and Service Design
1. Supply chain integration is enhanced by cross-functional teams working on product and service design.

2. Supply chain integration is enhanced by incorporating customer and supplier input in product and service design.

3. Supply chain integration is enhanced by modular product design.

4. Supply chain integration is enhanced by standardization and simplification of product and service design.

5. Supply chain integration is enhanced by design for supply chain.

Supply Chain Execution Processes
Supplier-Facing Processes
1. Supply chain integration is enhanced by frequent, regular communication between a company and its suppliers regarding demand and supply conditions — both current and future.

2. Supply chain integration is enhanced by a combination of linked computer-based information systems and person-to-person communication between an organization and its suppliers.

3. Supply chain integration is enhanced by collaborative decision-making between an organization and its key suppliers.

4. Supply chain integration is enhanced by clear communication of performance expectations and rewards.

Customer-Facing Processes
1. Supply chain integration is enhanced by advanced and formal forecasting processes, which are informed by multiple data streams, including customer input, third-party input and historical data. The forecasts should be supported by software, mathematical models, and experienced and informed human judgment.

2. Supply chain integration is enhanced by processes that incorporate the competitive priorities of the company to resolve allocations issues when demand exceeds supply.

3. Supply chain integration is enhanced by logistics, inventory management and return processes that incorporate competitive priorities of the company.

4. Supply chain integration is enhanced by including tier-1 suppliers who provide the goods and services to tier-1 customers in customer-facing processes.

5. Supply chain integration is enhanced by a combination of linked computer-based information systems and person-to-person communication between a company and its customers.

Sales and Operations Planning
1. Supply chain integration is enhanced by SOP processes executed by a dedicated cross-functional team with high-level executive sponsorship. Solid, trusting relationships with customers, strategic suppliers, senior managers and internal functions are critical to the success of sales and operations planning.

2. Supply chain integration is enhanced by SOP processes supported by reliable, valid, timely and accessible data on forecasts, inventory positions, internal factory capacity, supplier capacity, factory and supplier lead times, and sophisticated decision support systems.

3. Supply chain integration is enhanced by coordinating the company SOP processes with the SOP process at suppliers.
Communications and E-Systems
1. Supply chain integration is enhanced by frequent and regular people-to-people communication with buyers and suppliers at multiple levels in each organization.

2. Supply chain integration is enhanced by the systematic and standardized exchange of information through seamlessly connected e-systems.

3. Supply chain integration is enhanced by companywide data warehouses with standardized, rationalized and cleansed data.

Organization Structure and People
1. Supply chain integration is enhanced by an appropriate combination of centralized and decentralized authority and responsibility to balance buying power with flexibility and responsiveness.

2. Supply chain integration is enhanced by a senior supply chain executive with responsibility to drive alignment and linkage in the supply chain.

3. Supply chain integration is enhanced by cross-functional collaboration.

4. Supply chain integration is enhanced by a matrix organization structure with a customer/market focus that is linked to segmentation strategies.

5. Supply chain integration is enhanced by people who can understand the business beyond their narrow functional role.

6. Supply chain integration is enhanced by a comprehensive human resource development program to ensure availability of the needed talent.

Metrics
1. Supply chain integration is enhanced by a balanced scorecard approach to supply chain metrics.

2. Supply chain integration is enhanced by external customer-centric metrics.

3. Supply chain integration is enhanced by understanding the cause/effect relationship between process outputs and process changes, and external customer-centric metrics.

4. Supply chain integration is enhanced by using common supply chain metrics across trading partners.

Trust
1. Supply chain integration is enhanced by building trust across all levels of the trading partners based on long-term relationships and experience.

2. Supply chain integration is enhanced by building trust internally.

Implementation Priorities
After crafting a good supply chain vision that has broad executive input and support, the next priority for attention must be organization. While the supply chain organization must exist within and be compatible with the overarching organizational philosophy of the company, there remain many degrees of latitude for design. Organization of the supply chain should be a balanced between centralized and decentralized and should be formally matrixed or infused with cross-functional teams. The supply chain organization also should have multiple contact points with key suppliers and key customers, although all contacts should enable a common vision and strategies.

Following vision and organization, the next area for attention is metrics. Most companies are deficient in their implementation of customer-centric metrics. Without metrics in place, setting priorities for and judging the success of other implementation actions will be difficult. If the metrics are tied back to strategies and processes, clear avenues for action can be discerned, resources allocated and results evaluated.

After metrics, no clear hierarchy for action is evident among the other strategies, processes and enablers. In many companies, most of these areas will need improvement and could be candidates for early attention. Areas that are causing the most concern or problems should logically be addressed first. Action on these problems should show immediate benefits. Other areas, such as adopting new e-systems and building trust, may not be critical problems, but need constant, ongoing attention and regular review to ensure that progress continues to be made. Other areas, such as product and service design, may take several years to fully address because of the legacy designs and platforms in place.

Integration and the Bottom Line
We have no body of statistical data that clearly establishes the relationship of supply chain integration to profits or any other of the usual financial performance
metrics. We do have a multitude of case data and anecdotal data that indicate supply chain integration is closely related to financial prosperity. In other words, many knowledgeable business managers and executives believe this to be the case and are actively working to increase supply chain integration in their organizations. Based on our research observations, we strongly believe this to be true and recommend that companies take steps to address the supply chain integration issues before them.

All of our focus companies are leaders in their industries and all recognize that supply chain integration is important to their success. We chose them largely based on reports that indicate they demonstrate superior supply chain performance in their industries. Our interviews and investigations largely support these conclusions. Yet, even at these leading companies, we found many opportunities to improve the integration of their supply chains. This generally surprised the companies. Indeed, many of them were quick to point out these shortcomings to us, describe the challenges in making corrections and the actions they were planning. They were clearly convinced that continuing to improve their supply chain performance was vital in maintaining their industry leadership. Thus, we are comfortable in recommending these supply chain integration strategies, processes and enablers to a wider audience of companies and feel confident that most companies can benefit from their adoption.
To help the reader more fully understand the importance of supply chain integration in each of the case studies, we have prepared a brief overview of each industry in which the focus company competes. These overviews identify the major competitors in each industry, which also reveals the global nature of each industry segment. Additionally, the major competitive forces at work in each industry are identified and discussed. Most importantly, the role of supply chain management in each industry is highlighted. The five industry sectors are: Consumer Products, Semiconductors, Hospitality, Engineering Construction and Household Appliances.

**Consumer Product Industry — Personal Care and Household Products Sectors**

**Overview**
The personal care sector includes soaps, hair care, skin care, perfumes, toiletries and oral care products. The household products sector primarily comprises detergent products, laundry aids and household cleaners. The market environment for both segments is highly competitive, with global, regional and local competitors. Most of the industry’s subsegments include branded products and retailers’ private label brands. Additionally, many of the product segments are differentiated by price (premium, mid-tier and value-tier products).

### Major Players

<table>
<thead>
<tr>
<th>Company</th>
<th>2006 Revenues (billions of US$)</th>
<th>Country of Headquarters</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Procter &amp; Gamble Company</td>
<td>$76.5</td>
<td>USA</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>$53.3</td>
<td>USA</td>
</tr>
<tr>
<td>Unilever</td>
<td>$49.8</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>L’Oreal</td>
<td>$19.8</td>
<td>France</td>
</tr>
<tr>
<td>Kimberly-Clark Corporation</td>
<td>$16.7</td>
<td>USA</td>
</tr>
<tr>
<td>Henkel</td>
<td>$16.0</td>
<td>Germany</td>
</tr>
<tr>
<td>SCA</td>
<td>$13.8</td>
<td>Sweden</td>
</tr>
<tr>
<td>Colgate-Palmolive</td>
<td>$12.2</td>
<td>USA</td>
</tr>
<tr>
<td>Kao</td>
<td>$10.5</td>
<td>Japan</td>
</tr>
<tr>
<td>Reckitt Benckiser PLC</td>
<td>$9.1</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Avon</td>
<td>$8.7</td>
<td>USA</td>
</tr>
<tr>
<td>SC Johnson &amp; Son, Inc.</td>
<td>$7.0</td>
<td>USA</td>
</tr>
<tr>
<td>Clorox Company</td>
<td>$4.8</td>
<td>USA</td>
</tr>
</tbody>
</table>

*The CPC industry includes both of these sectors, plus many more from consumer electronics to tobacco to tires.*
Competitive Forces
All of the companies, which will be referred to as "CPCs" — consumer product companies — face challenges in both the personal care and household product sectors, including understanding consumer wants, fierce global competition, corporate social responsibility and cost management. An examination of each of these factors follows.

Consumers
CPCs continue to divide market segments into ever-smaller slices, resulting in consumers having more brand, product and service choices than ever. Consequently, consumers expect the brands they buy and use to meet their needs exactly. Success requires that consumer product companies understand needs at a micro-level and produce products that make people's lives easier, healthier and better. To meet this challenge, the companies must communicate with and listen to consumers carefully, and they must understand consumers' local culture and tastes. Success is ultimately about having world-class consumer insights. These insights are used to develop consumer-preferred new products, to build retail customers' categories with brands, to better target consumer segments and to communicate with consumers.

To gain world-class insights into consumer behavior, CPCs interact with consumers in numerous ways and invest heavily in market research. To learn more about consumers' tastes, preferences and desires, the companies spend time with people in their homes, observe the products they use and how they use the products. For example, one study among younger consumers in the Philippines helped a company identify non-traditional media outlets to more effectively launch products targeted to younger consumers. In another project, a CPC collaborated with local governments and schools to highlight personal care products and introduce new products at Internet cafes and popular cinemas, where samples were given to the public.

It is estimated that more than 50 percent of consumers make brand choices in the store, so CPCs accompany shoppers to better understand how they shop, what in-store products capture their attention and how they make brand choices. From this activity, they have learned how important it is for consumers to smell and feel products on the shelf. This has led to scratch-and-sniff strips on the packaging of new products and samples of products incorporated into the packing.

Technology also helps consumer product companies gain more insight into consumers by communicating with them in non-traditional ways. For example, an online network of mothers yielded valuable insight into grocery shopping behavior, while other interactive online communities of people with common interests have yielded insights that speed the development and quality of new products and marketing programs.

Initiatives to build insight into brand use, brand choices and shopper behavior are never-ending. Consistent leadership of product categories is based on listening and understanding the consumers, and on delivering a product mix that continuously evolves and delivers value.

Competitors
Some of the best companies in the world compete in these sectors with strong brands and strong capabilities. In addition, many retailers are creating their own brands and product lines that compete directly with CPC brands. Competition with local, low-cost consumer product companies in developing countries also is increasing. Competitive strategies revolve around Brand and Advertising, Technology, Innovation and New Products. These strategies are interrelated and supporting. An overview of these competitive strategies follows.

Brands and Advertising
The leading CPCs tend to focus on strong global brands in their core businesses and aspire to be number one or two in a category in which they compete. They strive to grow their core brands in both big markets and growing markets, and they heavily support the brands with advertising. CPCs can more easily bring new products to market on brands that already have strong equities and deep consumer trust. Therefore they use their leading global brands as platforms for innovation and brand-extending new products. Success is all about leveraging strong global brands, market share leadership and strategic marketing capabilities to fuel growth and hold on to their number one- or two-share position.

Winning in the marketplace requires a strong market position that delivers and sustains exceptional returns. Weak brand positions that don't have the potential to win in the marketplace are quickly sold of folded. To further build brand equity and market share, companies continually invest in marketing. By outspending on advertising and promotion in support of marketing, CPCs can beat out the competition and create significant barriers to entry.

Technology, Innovation, New Products
Consumer product companies are committed to attaining leadership positions through the development of innovative products and services. Based on the insight gained from observing and communicating with consumers, CPCs must find product solutions to customer needs. This requires a continuous stream of new and improved products, which is the reason
APPENDIX

thousands of new products are launched around the world each year. Product line extensions and packaging changes are continuous. To accomplish this, companies need deep technical expertise in a diverse mix of raw material and product technologies. For many companies, new products introduced over the last five years accounted for more than 30 percent of their 2006 sales.

Some companies are stressing the importance of innovation across their entire organization. Innovation is being infused into category innovation centers and across every geographic region to help accelerate new product activity. One CPC has designed a course for all employees that provides the knowledge and skills needed to develop an environment supportive of creativity, which in turn generates new ideas.

Recently, CPCs have recognized the need to reach outside their corporate boundaries to increase the flow of innovative ideas. The companies are increasingly using partnerships with external organizations to augment the internal product development process. These external partners include leaders in packaging, raw materials and technology as well as “think tanks,” institutes and universities. To compete against companies that are larger, smaller CPCs have leveraged outside relationships that can help them provide “virtual” scale. This has led to close partnerships with universities, strategic suppliers and even competing companies.

Corporate Social Responsibility
Increasingly, pressures from consumers, retailers, stockholders and other stakeholders are forcing consumer product companies to understand and act on the major sustainability issues facing their companies and the communities in which they operate. The companies are instituting programs to improve energy efficiency, water-use efficiency and reduce the amount of waste sent to landfills. They are reducing air emissions, water effluents and solid waste as a ratio to production, decreasing use of fossil fuel energies and limiting greenhouse gas emissions. One company, for example, is using only virgin wood pulp from suppliers who certify their forestlands or wood fiber procurement activities to an internationally recognized standard. The CPCs are finding that many of these programs also reduce annual operating costs.

Supply Chain Management
Rising commodity and energy costs are challenging to all CPCs that are systematically working to reduce the costs of raw materials, manufacturing and distribution, while still maintaining and improving the quality of their products. Many companies have implemented multiyear strategic cost-reduction programs to improve profitability and fund growth investments to improve their competitive position. Savings from purchased raw materials combined with savings from indirect materials and services are adding to margins. Generating strong cash flow is necessary to reinvest in the business and return cash to shareholders via dividends and share repurchases.

Some CPCs are achieving major cost savings by building a truly global supply chain, encompassing everything from global procurement of materials and services to the establishment of regional and global manufacturing and shared service centers as well as innovative distribution systems. This often includes consolidation into fewer, state-of-the-art, category-focused facilities. For example, one company is consolidating five European factories into a single plant in Poland. CPCs are re-engineering their supply chain processes to bring solutions to market more rapidly and to expand their portfolio of products. Optimal product availability in the marketplace demands integrated supply chains from product innovation, to product promotion, to on-shelf availability. It also requires the proactive balancing of supply and demand.

Retail partners play a critical role in helping consumer product companies reach consumers. In the past, success with customers has primarily been built on the strength of its number one and number two leadership brand positions. This is still true, but it’s no longer enough. CPCs also must integrate closely with their retail customers on a portfolio of high-impact, value-added, supply- and demand-building services. Services can include category management, creative customer co-marketing programs, expertise in supply chain and financial analysis, and consumer insights unique to a retailer’s target audience.

Bringing products to consumers in even the most remote villages is one key to building consumption and driving market share growth. That is one reason consumer product companies are expanding distribution networks around the world, especially in emerging markets. Strong demand for these products is found not only in Western markets but also in the new emerging markets where a relatively affluent middle class can now afford products that were once seen as luxuries. At the same time, to compete on a global basis, CPCs need strong supply networks and the ability to share best practices and successes among their business units.

Conclusions
The personal care and household products sectors are highly mature as reflected in the high level of competition and the difficulties consumer product companies face in differentiating and raising the price of their products. Retailers are becoming more powerful and this,
coupled with the increased popularity of private-label products, is resulting in increased pressure to hold or reduce prices. At the same time, consumers are becoming more price-conscious and less brand-conscious, and raw material prices are rising.

CPCs are taking several proactive measures to remain profitable in this competitive business environment. Improved margins have been gained through better designed and operated supply chains, improved supplier relationships and pricing, creation of manufacturing efficiencies and providing more value-added services to retailers.

Adding more value to their products is another tactic being employed by these companies. They are attempting to increase market share by convincing consumers to upgrade their purchases. As part of this strategy, a number of new value-added products have been introduced to the market, including vitamin-enriched and organic products. These products have enabled CPCs to obtain price increases and attract new customers.

Increased emphasis on consumer research also is helping consumer product companies maintain/improve market share. Companies are using their expanded knowledge of what interests the consumer with innovation, resulting in products that are closer to exactly what the consumer wants.

CPCs also are marketing their products with a focus on specific market niches. This has allowed companies to produce upscale products targeted at higher income consumers who previously made due with “generic” personal care products.

References

Note: Web references were accurate at the time research was conducted; however, researchers cannot guarantee URLs are still current.


## Semiconductor Industry

### Overview
Three types of companies are found in the semiconductor industry. There are chipmakers such as Intel and AMD that design, manufacture and sell their own chips. There also are fabless companies that design and sell chips, but do not manufacture them. Broadcom and Qualcomm are representatives of this class of companies. And there are foundry companies that manufacture chips designed and sold by other companies. Taiwan Semiconductor Manufacturing Company (TSMC) is a dominant company in this category.

<table>
<thead>
<tr>
<th>Company</th>
<th>2006 Revenues (source: iSupply Corporation) billions US$</th>
<th>Country of Headquarters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel</td>
<td>$31.5</td>
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<tr>
<td>Samsung Semiconductors</td>
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<tr>
<td>STMicroelectronics</td>
<td>$9.9</td>
<td>Italy and France</td>
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<td>Broadcom</td>
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<td>Elpida Memory</td>
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<td>Japan</td>
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<td>IBM Microelectronics</td>
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<tr>
<td>Rohm</td>
<td>$2.9</td>
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<td>Japan and USA</td>
</tr>
<tr>
<td>NVIDIA</td>
<td>$2.6</td>
<td>USA</td>
</tr>
</tbody>
</table>
Products from the semiconductor industry are vital to the operation of several other products and industries, including computers, home electronics and games, automobiles and manufacturing equipment. The industry has experienced continuous growth for more than 20 years, but has been subject to inordinate volatility in growth rates and profit margins. Worldwide semiconductor sales were estimated to be to $251 billion in 2006, according to World Semiconductor Trade Statistics (WSTS) Inc.

Competitive Forces
While the details vary somewhat among the different sectors, all companies in this industry face a number of competitive challenges, including fierce global competition; the need for large spending on research and development; the need for large capital investments (for manufacturers); a shifting product base; evolving technologies with many resulting niche markets; and complex supply chains. Following is an in-depth look at these challenges.

Global Competition
As is evident from the preceding table, the semiconductor industry is truly global. Giant firms headquartered in North America, Europe and Asia all battle for global sales in many market segments. Each of the major segments tends to be dominated by one or two firms. However, even the dominant firms cannot be complacent, as the technology is continually changing and giving rise to opportunities for new competitors to enter the field or for old competitors to leap ahead.

One factor keeping the semiconductor industry globally oriented is the outsourcing of wafer fabrication to other countries, mostly by U.S. fabless companies. Taiwan foundries are the major recipients of this business, but Singapore also plays a key role, and China is emerging as a competitor in the industry.

Some of the major market segments are:

- **Microprocessors** — Microprocessors are used primarily in computers, but they are also important to the telecommunications, electronics and automobile industries. They are sometimes called central processing units because they control and coordinate the processing of data from all other points of a computer. Microprocessors pack thousands or even millions of transistors into a very small area. This segment is dominated by Intel and AMD.

- **Memory Products** — Dynamic random-access memory (DRAM) chips are most common in personal computers. They store information quickly and cheaply and allow it to be accessed relatively rapidly. Static random-access memory (SRAM) performs the same functions as DRAM, but is much faster. SRAM chips retain information with less current and operate much faster than DRAM. SRAM, however, is more complicated to manufacture and costs more than DRAM. Continually expanded processor power and function necessitate a corresponding upgrade in RAM modules. The DRAM segment is dominated by Samsung. However, several other strong companies including Micron Technology, Infineon/Qimonda, and Hynix compete in this market. The flash memory chip is a nonvolatile semiconductor that can be erased and reprogrammed electrically. Flash memory chips are found in communications equipment as well as in computing devices.

- **Logic Devices** (including ASICS) — Logic devices control the ways in which information is transmitted and interpreted within a single system. While most other types of semiconductors can be used in different types of equipment without major changes, logic devices usually have to be designed to fit into a particular system. There are three main categories of logic devices: complex programmable logic devices, field programmable logic devices and application-specific integrated circuits (ASICs). The two programmable logic devices are fairly standard across the industry. Their value lies in the fact that manufacturers can modify them to suit their particular needs by using electrical codes. The ASICs have to be designed and constructed for a particular function and thus tend to be more expensive. LSI Corporation is a leader in ASICs, but there are many other companies in this highly segmented market.

- **Digital Signal Processing** — The goal of digital signal processing is to convert continuous real-world analog signals into a digital form for processing. The output of this processing may be converted back into an analog signal. Subsegments include voice and audio, radar and sonar, biomedical and seismic data processing. This segment is dominated by Texas Instruments and STMicroelectronics.

All of the companies in the industry have been faced with competition into their core business, periodic shortages of material inputs and unsuccessful forays into niche markets. To defend market share and shore up margins, they have fought back with aggressive price competition and new brand initiatives. The companies also have rolled
out new and improved products at a faster pace and have improved manufacturing technology and efficiency. Pricing wars periodically break out, depressing revenues and margins. Customers routinely take advantage of the competition to play one manufacturer against another to get price and service concessions. This competition has a major impact on the price of personal computers in particular, but also impacts many other products that use microprocessors, memory and logic products.

Global Markets
Although U.S. companies have a major stake in the world's semiconductor business, they represent less than one-third of global sales. The Asia/Pacific region generates more than half of the revenues for the major semiconductor manufacturers, and China is a significant portion of that share. This represents both the outsourcing to fabrication plants in Asia and the growing Asian market for devices powered by semiconductor devices.

R&D Spend and New Product Development
The most important trend in the semiconductor industry is the continual move toward miniaturization. Key to producing more powerful semiconductors is increasing the number of transistors that can fit on a single chip. The number of transistors on a single chip controls the chip's power. In 1971, when the first microprocessor was developed, its transistors measured 10 microns in size. By 2005, manufacturers produced semiconductors containing circuits with lines less than 0.13 microns across. Finer lines enable more transistors to be packed onto the same chip. The more transistors on a chip, the faster it can perform its functions.

Faster processors with less power consumption are the name of the game for microprocessors. Moore's Law (doubling of processor speed every 18 months) continues to hold up, although there have been suggestions that the current technology may not be able to continue this trend. The latest development is the advent of chips with multiple processing cores. Both major manufacturers of CPUs now offer such chips. These chips need less power to operate and do not require extensive chip-cooling features.

Digital signal processing (DSP) also is taking advantage of miniaturization. New DSP technologies enable more highly integrated components for customers in areas such as wireless and broadband communications. In some cases, several kinds of chips for a single electronic device can be provided, such as separate chips that enable the telephone and camera features in cell phones. The use of digital processing is expected to become more widespread in areas such as communications and medical equipment.

In the first decade of the 2000s, the industry buzzword in the area of research and development was “nanotechnology.” The need for joint research ventures to develop such technologies prompted Infineon, Intel, Philips, Samsung and STMicroelectronics to sign on for a sub-45-nm research program at the Inter-university MicroElectronics Center in Belgium. By 2006, Intel and at least three other companies were producing 65-nm technology.

Manufacturing Facilities
With the cost to build and equip a new wafer (fab) plant in the billions of dollars, semiconductor manufacturing is not for the faint of heart or poor of pocket. New semiconductor designs require new manufacturing technology. Additionally, old designs can be made more efficiently with new manufacturing technology. As wafers grow larger and circuits grow thinner, more and more components can be crammed into one chip and more chips onto one wafer.

Semiconductor companies are building wafer plants and assembly test plants in many countries, with Asia a particularly popular location. For example, Intel will build a 300mm wafer fabrication plant in Dalian, a city in northeast China. The $2.5 billion project will be the company's first wafer fab in Asia. Intel already has semiconductor assembly and test plants at three sites in China and is building a $1 billion assembly and test facility in Vietnam. TI has committed to spending $1 billion over 10 years to expand its chip assembly and test operations in the Philippines, including a new facility in the Clark Freeport Zone, the site of a former U.S. Air Force base. TI has an existing facility in Baguio City, a plant that opened in 1979. Samsung has plowed billions of dollars into capital improvements and new factories, including state-of-the-art chip plants in South Korea. In addition to pumping out low-margin commodity DRAMs for PCs, Samsung is making high-margin DRAMs for specialized application.

Not all of the action is in Asia. AMD plans to build a new fab in Malta, New York, and expects to spend more than $5 billion over five years on the project. Samsung picked Austin, Texas, as the site of its first wafer fab outside of South Korea in 1996. In 2005, Samsung chose Austin as the site of a new semiconductor plant, one that will produce chips on 300mm silicon wafers.

Niche Markets and Joint Ventures
Most of the major semiconductor companies have made moves into niche products and markets. These moves are usually predicated on being first movers into promising new products that have the potential to add billions to revenue. However, many do not grow as forecasted or become targets for fierce competition,
driving down margins. These products lines are often sold off or merged into a joint venture with another company's compatible line of business. This allows the parent company to concentrate on its core products and/or look for new promising niche products that can be grown into significant lines of revenue. For example, Intel combines its flash memory business with the flash memory lines of STMicroelectronics into a new standalone company named Numonyx, based in Switzerland with operations worldwide. At the same time, an separate joint venture with Micron Technology, called IM Flash Technologies, to make NAND flash memories. Similarly, AMD spun off its flash memory device business into another joint venture with Fujitsu in a company called Spansion.

Supply Chain Management
Global markets, global manufacturing, outsourcing and the need for specialized, high-efficiency plants have created very complex supply chains for the semiconductor industry. Raw material, components and end products flow through a complex maze of plants, contract manufacturers and transportation systems to customers and consumers. Not only do some of the semiconductor companies outsource manufacturing, most of their customers also outsource. This creates immense problems in gaining visibility into the actual demand for products, the inventory in place around the world and the available capacity at any time. Demand forecasts can be subject to severe swings. New consumer products catch on, ramp up demand and then disappear as they are displaced by new models or new products. The holiday buying season alone can set up “bull whip” effects in the supply chain as independent decisions are made by trading partners to cope with the changes in demand. This is often exacerbated by shortages of parts or capacity to build parts. Companies over-order and suppliers over-promise, while none understand the “true” demand or capacity situation.

For these reasons, supply chain integration is increasingly important in the semiconductor industry. Customers and suppliers need a complex exchange of information at the tactical and strategic level to anticipate and/or respond to the ever-changing marketplace. The exchange is typically not complete due to competitive considerations and the need for each company to put its interest first. Nonetheless, more integration can lead to better results for the trading partners.

Conclusions
Technological developments continue to shape and change the competitive landscape in the semiconductor industry. Promising new technologies, such as nano and strained silicon, take time and large resources to develop, and the commercialization timelines and payoffs are highly uncertain. Yet, the sector leaders cannot afford to ignore them for fear of being left behind or shut out by intellectual protection fences. Faster, better and cheaper technologies are always just around the corner.

References
Note: Web references were accurate at the time research was conducted; however, researchers cannot guarantee URLs are still current.

Annual reports viewed at:


www.hoovers.com
The industry is dominated by hotel chains, especially in
the United States and Europe, although Asia is
experiencing a large increase in investment by the
leading chains. The world’s top-10 hotel groups handle
three-quarters of the global hotel market. About 70
percent of these hotels are located in Europe and North
America. Most of the world’s largest hotel chains are
based in the United States.

### Major Competitors

<table>
<thead>
<tr>
<th>Company</th>
<th>2006 Revenues (billions of US$)</th>
<th>2006 Number of Locations Worldwide</th>
<th>Country of Headquarters</th>
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<td>Choice Hotels International, Inc.</td>
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<td>USA</td>
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### Competitive Forces

The companies in this industry face a number of
competitive challenges, including global and local
competition in every market niche, complex participa-
tion arrangements, and a shifting array of partnerships
and affiliations. Following is an in-depth look at these
challenges.

**Industry Markets**

There is strong competition in the lodging business in
the United States. All of the major lodging chains
operate numerous brands to appeal to different
segments of the market and to achieve different price
points.

International hotel owners and operators have
expanded into the United States through direct
investment in well-known U.S. hotels. This investment
and acquisition strategy is used because the U.S.
lodging industry is an extremely competitive market
already full of well-established and commonly known
brand-name hotels. Given this level of development, a
substantial investment would be necessary for a new
compny to successfully enter the U.S. market with a
new product line.

Demand growth in the lodging industry is driven by
two main factors: the general health of the travel and
tourism industry and corporate spending on business
travel. In the past few years demand has been outpacing
supply, creating a favorable business environment for
lodging companies. The hotel industry continues to rely
on both business and leisure travelers. Since the 1980s
business travel has been the leading moneymaker for
hotels, providing nearly two-thirds of all sales. Nonethe-
less, leisure travel increased during this period as well.

Each year, the hotel industry has increased its marketing
dollars for campaigns to attract more business and
leisure travelers. Yet, many travelers still left their
destinations dissatisfied with the level of service
received and their overall experience. It remains a
challenge for hospitality companies to get beyond
creative campaigns and provide the quality of service
that generates return visits and positive word of mouth.

The lodging industry generally can be divided into four
main segments — luxury, upscale (which also includes
upper upscale properties,) midscale (which is often
further split into midscale with food and beverage and
midscale without food and beverage,) and economy.
Luxury and upscale hotels typically offer a full range of
... on-property amenities and services including restaurants, spas, recreational facilities, business center, concierge, room service and local transportation (shuttle service to airport, local attractions and shopping). Midscale segment properties typically offer limited breakfast service, vending, selected business services, partial recreational facilities (either a pool or fitness equipment) and limited transportation (airport shuttle). Economy properties typically offer a swimming pool and airport shuttle.

The robust business segment of the industry also gave rise to extended-stay hotels that specifically targeted business travelers and have high occupancy rates. With 20 percent more space than a conventional hotel room, a suite is separated into a living area and a bedroom. A second type of all-suite property is the growing category of extended- and long-stay properties. Catering to guests who stay five days or longer, the extended-stay suite provides a full kitchen.

The hotel industry, especially in the United States, has experienced substantial structural changes as a result of hotel segmentation and the consolidation of companies. As the industry tries to target different customer segments such as business traveler or budget-minded vacationer, hotel chains have divided lodging facilities along the line of price, service and space. With U.S. companies leading international expansion, the use of segmentation has spread to areas outside North America. Segmentation also has enabled companies to leverage corporate resources such as management experience, access to capital markets, back-office operations and supply management.

Another strong trend in the industry is the adoption of computer technology. Hotel companies have turned to technology to standardize operations, communicate among properties and the home office, and create more efficient and cost-effective operations, including purchasing and supply management. Centralized reservation systems are critical to any large hotel chain.

Lodging companies have found that segmentation has added to their growth. Because hoteliers have had little control over increasing demand, they instead have expanded their customer base by providing all levels of lodging managed by one parent company.

**Industry Participation**

There are three major forms of participation in the lodging industry: straight ownership of properties, management agreements and franchising or licensing a brand name. Most large hotel companies are active in all three categories, creating flexibility to respond to market needs.

- **Ownership** — Under the ownership model, a company owns properties and benefits financially from hotel revenues and any appreciation in the value of the properties.

- **Management** — Under the management model, a company provides property management services to lodging properties that it owns and/or lodging properties owned by a third-party in exchange for management fees, which may include incentive fees based on the financial performances of the properties. There are more than 600 lodging management companies in the United States. These operators are mostly private management firms, but also include several large national chains that own and operate their own hotels, operate hotels for owners and also franchise their brands. Contracts for hotel management/operation are typically long-term obligations, but most allow the hotel owner to replace the management firm if certain financial or performance criteria are not met.

- **Franchise** — Under the franchise model, a company grants the use of a brand name to owners of hotels that the company neither owns nor manages in exchange for royalty fees that are typically equal to a percentage of room sales. Owners of independent hotels increasingly have been affiliating their hotels with national lodging franchise brands as a means to remain competitive. In 2006, the share of hotel rooms in the United States affiliated with a national lodging chain was approximately 67 percent.

The desire of many hotel companies to reduce capital investment and related risks has given franchising a large boost. Large franchise chains are based on the benefits of brand name recognition, for which a property operator either pays a straight fee or gives up a percentage of revenue. The name represents a specific concept and standard, consistent at every location, which appeals to many consumers. Through license or franchise agreements, hotel companies can generate revenues from limited capital investments and can market their brands more broadly. Franchises also provide the company a greater efficiency in the use of resources, especially buying leverage for supplies and capital equipment.

The industry can be further classified into full- and limited-service enterprises. Full-service hotels constitute the majority of all properties, although this ratio is declining. Typically, they are large properties that often generate about 30 percent of their operating income from food, beverage, and such services as restaurants, room service and meeting spaces. Limited-service hotels
are smaller establishments that do not offer food and beverage services or extra facilities. They rely on room sales for nearly 95 percent of their revenue base.

Large differences exist in the expenditures that each type of hotel incurs for various services, including room maintenance, food and beverages, and telephones. These costs can diminish profit margins considerably in years with low occupancy rates, especially given that hotels must also keep room rates low in such years to compete for a reduced number of customers.

**Affiliations and Partnerships**

Recently, hotel chains have developed agreements of various kinds with other industries that serve travelers. For example, frequent-flier/guest/renter programs have been developed in cooperation with airline and car rental companies. These programs offer “points” for air travel, hotel visits and car rentals that can be redeemed for upgrades and rewards through any of the three partners. These programs are geared toward fostering brand loyalty in the leisure traveler and the corporate traveler.

Relationships with travel agencies and tour operators have historically been important to the success of many hotels. Agencies are a crucial sales mechanism for the industry. Agreements with tour operators offer substantial room discounts on bulk bookings. However, in the mid-2000s travel agents were facing challenges from the proliferation of the number of customers who booked travel and accommodations via the Internet, bypassing travel agencies altogether.

With a growing global market and increased customer needs, communication among individual hotels, the corporate office, travel agencies and airlines is critical for success. Information systems are one the most important operational tools in the hotel industry, improving both efficiencies and guest services. Most hotels have automated front-office functions such as reservation applications, yield management (maximizing occupancy or revenues at any given time) and integrating their point-of-sale and restaurant computer systems. In addition, hotels have begun using the Internet to market their services and to enable customers to make reservations and obtain information online.

**Supply Chain Management**

Supply organizations for hotels (owned, operated or franchised) are especially important to achieving hotel profitability. The larger chains have developed their own purchasing organizations that buy for their parent companies’ owned and operated hotels. These organizations aggregate the demand across the units to gain market power. They are also instrumental in helping to standardize the materials and supplies used in the various properties. This helps increase the demand and also supports the branding efforts of the chain. Supply organizations also market their services to the franchised hotels that may buy all or part of their supplies and capital equipment through the buying organization. A number of unaffiliated buying groups also exist, primarily serving the independent properties and the smaller ownership groups.

While the benefits of aggregate buying can be readily appreciated, just as important is the ability of a buying group to find and qualify local and regional suppliers of perishable goods. National suppliers of these goods generally are not available. Buying groups can source the logistics providers necessary for on-time and safe delivery of supplies and capital equipment at multiple sites, not an easy task.

Increasingly, supply groups are supporting the branding efforts of the hotel companies and their segments by finding sources that can meet the demand for specialized designs and room furnishings. The special designs and configurations help establish the identity of one segment from another and within a segment, one brand from another. Customization by brand has reached down to the level of coffee makers and pillows. Supply organizations have been charged with finding designers for these items and sourcing their manufacture on a cost-competitive basis. This often means going to competitive-cost countries to find and, often, develop new sources.

**Conclusions**

The lodging industry is in a continual state of ownership and brand changes. Lodging companies are regularly acquired and sold off, often in pieces. Lodging companies themselves buy and sell properties and franchises as strategies change, markets change and properties age. New hotels are continually being constructed, especially in the suburbs and around transportation hubs, to meet the needs of the expanding economy.

Brand proliferation is a challenge in the industry, as market segments are divided into smaller and smaller pieces and are populated with additional brands. Even within a chain, companies struggle to create meaningful differences in brand properties that allow them to maintain market segments and prices points.

When demand is strong, which was true of the mid-2000s, pricing becomes relatively less important; services, location and loyalty become more important. Even so, to maintain margins, cost control is an...
essential but ongoing challenge. Staff turnover in the hospitality industry is notoriously high, which contributes to high labor costs. Maintaining cost control for supplies and capital equipments requires sophisticated buying organizations with category expertise. Delivery to multiple properties spread across the country is a continual challenge that requires first-rate logistics services.

The industry is not immune to foreign competition, as hotel companies headquartered in Europe build and purchase properties in the United States. Such investments are made even more appealing by the weak U.S. dollar. The weak dollar also gives a boost to tourism in the United States, but more of this demand for lodging may be met by foreign-owned brands in the United States.

References
Note: Web references were accurate at the time research was conducted; however, researchers cannot guarantee URLs are still current.


The International Hotel Industry, Travel & Tourism Intelligence published by MSCO International Group Ltd. — June 2005.


www.hoovers.com

**Engineering and Construction Industry**

**Overview**

Services from the engineering and construction industry fall into four broad categories—engineering, procurement, construction and operations/maintenance. Operations/maintenance includes services performed in connection with operating large complex facilities on behalf of clients, as well as services involving process plant maintenance. Engineering, procurement and construction are usually provided on a project-by-project basis. Operations/maintenance services are provided, by necessity, on an ongoing basis. These services may be offered independently or on a fully integrated basis. Services can be purchased separately, giving companies the opportunity to specialize in only one of the services, for example, engineering design or construction. Other firms concentrate on selected industry groups and/or markets including oil and gas exploration, production and refining; various national governments programs, such as aerospace; pharmaceuticals and biotechnology; chemical; buildings; consumer products; and pulp and paper. However, the largest firms in the industry are fully integrated and compete in part on the basis of offering a full-range of services. In a specific project, the provider’s role may involve providing front-end engineering.
program management and final design services, construction management services, construction, oversight of other contractors and the responsibility for the procurement of labor, materials, equipment and subcontractors.

The type of projects up for bid influences the degree and type of competition each company faces. For example, construction, and operations and maintenance services are often large projects that are awarded to large contractors that have an inherent advantage over small contractors. Conversely, the small amount of capital required for a business providing engineering, design, architectural and consulting services creates a relative ease of market entry for a new company possessing acceptable professional qualifications and certifications. Consequently, within the industry, companies range from small local or regional firms to large national and international organizations.

## Competitive Forces
The companies in this industry face a number of competitive challenges, including global markets with multiple niches, global and local competitors, and a challenging array of competitive success factors. Following is an in-depth look at these challenges.

## Major Markets
Serving multiple markets across a broad spectrum of industries provides diversity that can mitigate the impact of the cyclicality in the individual markets. A good balance across a business portfolio enables companies to focus on more stable business markets, while permitting them to be ready to capitalize on developing or cyclical markets at appropriate times. The following is a look at the major markets in the engineering and construction industry.

### Oil and Gas
As the demand for oil and gas continues to increase, the global oil and gas production and processing industries offer a full range of business opportunities. These include upstream oil and gas production, downstream refining and integrated petrochemicals. But as the locations for large-scale oil and gas projects become more remote, this market segment is becoming more challenging geographically, geopolitically and technically.

In the upstream sector, increasing demand for oil and gas coupled with high oil and gas prices have resulted in new opportunities, including the development of major new fields, liquefied natural gas projects and gas-to-liquids projects. Typical projects include new design and construction, revamps or expansions and maintenance.

### Top Competitors

<table>
<thead>
<tr>
<th>Company</th>
<th>2006 Revenues (billions of US$)</th>
<th>Country of Headquarters</th>
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services. Projects in the upstream market include heavy oil processing (for example, oil sands extraction projects); oil recovery through steam injection; gas treating, gas gathering and gas storage projects.

In the downstream sector, demand for refined products continues to increase on a global basis. New opportunities are available in the petrochemicals market, especially in developing markets where the demand is rapidly increasing. Typical projects include new design and construction, revamps or expansions of existing plants, upgrades of individual process units within refineries, and maintenance services.

Government regulations continue to influence the need for project services. An increasing number of countries continue to implement stronger environmental policies creating the need to produce cleaner fuels. Ongoing project activity exists in refining due to formulation and sulfur directives. New and existing environmental regulations will continue to drive new investment requirements over the next several years.

Refineries are also responding to changes in feedstock price and availability as well as the product marketplace. This is leading to investment in the development of heavier crude with higher sulfur content and producing a different product slate. New and existing refinery capacity in the Middle East and Asia is occurring due to the overall desire to add value at source and to respond to the regional consumption growth.

Industrial
The industrial segment includes a wide range of manufacturers such as automobiles, aerospace and defense, life sciences, microelectronics, pulp and paper, food and consumer products, and telecommunications. As commodity prices and demand increase, mining becomes a particularly strong area of growth.

Aerospace and defense programs include support to aerodynamic, propulsion, and space facilities and systems for government clients. This includes military systems acquisition management and strategic planning; operations and maintenance of test facilities, ranges, space launch facilities, and space chambers.

The chemicals and polymers market is growing with expansions and revamps attracting investments in North America and Europe. Additionally, a large volume of new investment is occurring in the Middle East and Asia due to both low feedstock cost and rapidly growing local markets.

Typical projects for pharmaceuticals and biotechnology include laboratories; research and development facilities; pilot plants; bulk active pharmaceutical ingredient production facilities; full-scale biotechnology production facilities; and secondary manufacturing facilities. Regulatory compliance issues, state-of-the-art technology and expertise are critical in these industries.

Government and Infrastructure
Because the U.S. government is the single largest purchaser of outsourced services in the world with a relatively stable year-to-year budget, this is an attractive market segment for many providers, large and small.

Transportation infrastructure development and rehabilitation integrates a broad range of professional disciplines. Interdisciplinary teams work independently or as an extension of agency staff on highway; bridge; transit; tunnel/underground; airport; railroad; inter-modal facility; maritime; and lock and dam projects. Many projects in transportation involve the use of so-called public/private partnerships. Under these arrangements, companies develop and finance deals in concert with public entities for projects such as toll roads, which would not have started with public funding alone.

Environmental restoration work provides many opportunities, including underground storage tank removal, contaminated soil and water remediation, and long-term groundwater monitoring and various types of soil and groundwater cleanup systems. Typical projects include the preparation of feasibility studies and performance of remedial investigations, engineering, design, and remediation services.

Government programs include many types of building programs for a variety of agencies. Buildings often include a full range of design and construction activities related to institutional, government and corporate buildings as well as other specialized facilities. Typical projects include large, multiyear, government building programs; major primary and secondary education capital improvement programs; state and local government courts and correctional facilities; and hospitals and health and research facilities.

Power
The power segment includes design and construction of new power generation facilities and the design and installation of emissions equipment to comply with environmental guidelines. Additional services can include operational improvements, predictive and preventive maintenance, and turbine fleet management. Also, demand for cogeneration system design by industrial firms, which improves power production efficiency by deriving more energy from the same
amount of resources, continues to grow. Finally, many of the world’s nuclear plants are in need of upgrades, which presents business opportunities.

Services
Service areas in this segment include operations and maintenance activities, construction and maintenance site services, industrial fleet outsourcing, plant turnaround services, temporary staffing, materials and subcontract procurement, and construction-related support. These markets are largely driven by the growing demand from customers to outsource non-core services to third-party providers.

Basis for Competition
Competing on a global basis in a competitive marketplace gives rise to many complex challenges that must be successfully met for companies to survive in this industry. Some of the most complex challenges are described below.

Diversification
Diversification has emerged as one of the most important competitive factors. To remain viable and competitive in cyclical markets, companies in this industry have turned to diversification of products and services, and of geography. Globalization had become almost a prerequisite for participation and success in the industry, even for midsized companies. International growth is an important factor for the major industry players, no matter the home country. The largest companies in this industry compete on a global basis and in many of the markets described above. Smaller companies specialize in fewer segments and geographies. A global footprint provides the opportunity to build local relationships that enable companies to capitalize on opportunities all over the world. In addition, a global reach allows quick mobilization to those locations where many projects arise.

Excellence in Execution
The ability to engineer, construct and manage complex projects in geographically challenged locations, while bringing projects in on schedule and meeting or exceeding all client specifications, is a distinct competitive advantage. In an increasingly competitive environment, cost controls are important so that clients achieve not only their performance requirements but also their budget requirements. Strategic purchasing services play a major part in the companies’ efforts to meet schedule and budget goals.

Safety
A safe work environment is critical to long-term success and growth. Construction sites and maintenance sites are inherently dangerous workplaces. Therefore safety is a core value and a fundamental business strategy in the construction industry. For both the companies and their clients, the maintenance of a safe workplace is a key business driver. Providing an injury- and incident-free work environment is an absolute condition of the relationship among the companies, their employees and their clients. Unsafe job sites and office environments increase employee turnover, increase the cost of a projects, expose providers to unacceptable levels of risk and raise operating costs. Conversely, safe job sites benefit clients, promote employee morale and enhance the long-term relationships.

Long-Term Client Relationships
Many of the companies in this industry have built long-term relationships with their major clients, often after decades of working with them. This relationship-based business model is central to their growth and profitability. These relationships allow companies to better understand many of the risks they face with a project or a client, and therefore to approach problems proactively to help manage the risk. These strategic alliances enable providers to increase their understanding of the overall business needs as well as the unique technical requirements of each project. This increased understanding also gives companies the opportunity to sell a greater range of services for the project. By integrating and bundling services, such as providing design, engineering and construction services on the same project, companies can price contracts more competitively and enhance overall profitability while delivering superior value. The partnership model, however, does not preclude companies in the industry from undertaking discrete projects if they can negotiate acceptable pricing and other contract terms and conditions.

Risk Management
The ability to assess, understand and gauge project risk, especially in difficult locations or circumstances or in a lump sum contracting environment, allows companies to selectively enter into markets or accept projects and to avoid projects with unacceptably large risks.

Cyclical Nature of Markets
The demand for services and products depends on the existence of projects with engineering, procurement, construction and management needs. Downturns can negatively impact an entire business. International operations are subject to foreign economic and political uncertainties. Unexpected and adverse changes in foreign governments can result in project disruptions, increased costs and losses.

International Operations
Operating in the international marketplace exposes companies to many risks including abrupt changes in
foreign government policies and regulations; embargoes and trade restrictions; tax increases; changes in U.S. government policies; and international hostilities. The lack of a well-developed legal system in some countries makes it difficult to enforce contractual rights. Companies can face significant risks due to civil strife, acts of war, terrorism and insurrection.

U.S. Government Regulation
Contracts with the United States and other governments and their agencies are subject to various uncertainties, restrictions and regulations. In the United States, government contracts are also exposed to uncertainties associated with funding. The U.S. federal government is under no obligation to maintain funding at any specific level, and funds for a program may even be eliminated.

U.S. government contracts are subject to specific procurement regulations and a variety of other socio-economic requirements, such as the Federal Acquisition Regulation, the Truth in Negotiations Act, the Cost Accounting Standards, the Service Contract Act and Department of Defense security regulations. Failure to comply with any of these regulations, requirements or statutes can result in contract termination and companies being debarred from future government work.

High Security Risks
Some services are performed in high-risk locations, such as Iraq, where the country or location is suffering from political, social or economic issues, or war or civil unrest. In those locations, companies may incur substantial security costs to maintain the safety of personnel. Furthermore, the risks inordinately increase personnel costs in these regions.

Exposure to Foreign Currency Fluctuations
Changes in the value of foreign currencies can increase U.S. dollar costs or reduce U.S. dollar revenues from foreign operations. Any increased costs or reduced revenues as a result of foreign currency fluctuations could eventually impact profits if the currency risks are not adequately hedged.

Talent
There is a large and growing demand for skilled employees who are able to perform the services needed in this industry. Business success depends on the ability to attract and retain personnel, including engineers, architects, designers and corporate management (including supply chain) professionals who have the necessary and required experience and expertise. In addition, there is significant demand for qualified craft personnel in the geographic areas where construction and maintenance sites are located. For U.S.-based firms particularly, the domestic supply is not keeping up with demand. Consequently more engineering work is being offshored, especially to India. Companies are hiring engineers in developing markets, such as India and China, while other work is outsourced to third parties in developing economies.

Supply Chain Management
Nearly two-thirds of the money spent on engineering and construction projects flows through supply management. Increasingly, engineering and construction companies have realized that they can maximize their value to clients and create significant competitive advantage for themselves by viewing supply management as a strategic part of the total project. Research by the construction industry reveals that early supplier integration into projects and awarding strategic supply items earlier on a typical project can produce price savings of 4 percent to 8 percent and dramatic savings of 10 percent to 15 percent in the time to complete the project. Procurement services include strategic sourcing and supply processes aimed at improving product quality and performance while also reducing project cost and schedule. Global sourcing and supply expertise, global purchasing volume, access, technical knowledge, competitive pricing and attention to service provide supply management advantages. Activities include sourcing, material control, buying, procurement management, expediting, supplier quality inspection, logistics and field material management. Encouraging and facilitating early supply involvement in projects and assuring available material when needed have become major value-added procurement services provided by companies in the industry.

Completing complex projects in remote parts of the world can be a supply chain nightmare. Much of the work is outsourced to third-party subcontractors while third-party equipment manufacturers or suppliers provide much of the equipment. Some suppliers and subcontractors for a project may have contracts with both the project owners and the engineering-construction firm. Keeping material flowing and work completed on schedule requires close communication and coordination among the many parties involved with the project.

Adding to the challenge are escalating prices for raw materials used in this industry (e.g. steel and cement) and increases in procurement lead times as demand outstrips supply. The supply of some equipment, such as compressors and pumps, is also short. Some of the equipment shortage is due to capacity constraints in tier-2 suppliers, such as foundries and castings, forcing the contractors to look deep within their supply chains for potential supply problems.
To achieve savings and deliver value, companies have put programs into place that foster close working relationships among all project participants. The integrated project team includes customer, contractors and subcontractors who collaborate at each stage of the development work. Suppliers are motivated to work on the early involvement teams in exchange for establishing a preferred relationship with the company and its clients. From the outset, the integrated project team works together on tasks ranging from developing project scope, schedules and costs, to planning and estimating work items. In addition to their contributions during early design and engineering phases, team members play a major role in establishing criteria and recommending solutions for all aspects of the project. This integration helps reduce engineering efforts, shorten cycle times and lessen project risk, all of which help to reduce costs and shorten project completion time.

Conclusions

The growing world economy and concomitant demand for resources and products has created a growing and profitable market for engineering and construction firms. However, to meet the market demands, providers have been drawn into many large and complex projects located in difficult geographies and uncertain political environments. Out of necessity, the engineering and construction companies, along with their customers and suppliers, have responded by creating highly integrated supply chains. Of all industries, the major companies in this industry may be the closest to truly managing a multitier supply chain. However, this integration may be challenged in the future by the inherent stresses of the business, the growing demand, the growing costs of raw materials and equipment, and the shortage of skilled talent.

References

Note: Web references were accurate at the time research was conducted; however, researchers cannot guarantee URLs are still current.


Household Appliance Industry

Overview
The household appliances industry includes six product sectors: refrigeration appliances, cooking appliances, washing appliances, heaters, vacuum cleaners and dishwashers. The approximate size of each market segment is shown below.

Appliance Market by Segment Size

<table>
<thead>
<tr>
<th>Category</th>
<th>Market Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking Apparatus</td>
<td>35.3%</td>
</tr>
<tr>
<td>Refrigeration</td>
<td>27.4%</td>
</tr>
<tr>
<td>Washers</td>
<td>20.0%</td>
</tr>
<tr>
<td>Vacuum Cleaners</td>
<td>6.9%</td>
</tr>
<tr>
<td>Dishwashers</td>
<td>5.4%</td>
</tr>
<tr>
<td>Heaters</td>
<td>5.0%</td>
</tr>
</tbody>
</table>

Major Competitors
The major manufacturers of these appliances and their 2006 revenue are shown below. Note that in cases marked with an *, the revenue numbers for household appliances cannot be distinguished from larger business units.

<table>
<thead>
<tr>
<th>Company</th>
<th>2006 Revenues (billions of US$)</th>
<th>Country of Headquarters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whirlpool</td>
<td>$18.1</td>
<td>USA</td>
</tr>
<tr>
<td>LG Electronics*</td>
<td>$17.4</td>
<td>Korea</td>
</tr>
<tr>
<td>Electrolux</td>
<td>$15.2</td>
<td>Sweden</td>
</tr>
<tr>
<td>Haier Group*</td>
<td>$13.9</td>
<td>China</td>
</tr>
<tr>
<td>General Electric — Consumer and Industrial Division*</td>
<td>$13.8</td>
<td>USA</td>
</tr>
<tr>
<td>BSH</td>
<td>$12.3</td>
<td>Germany</td>
</tr>
<tr>
<td>Phillips — Appliances</td>
<td>$12</td>
<td>Netherlands</td>
</tr>
<tr>
<td>Samsung — Digital Appliance*</td>
<td>$5.5</td>
<td>Korea</td>
</tr>
</tbody>
</table>

In recent years there has been a major consolidation among appliance-makers in the United States. The last such change occurred in 2006 when Whirlpool bought Maytag. With only two remaining major appliance manufacturers headquartered in the United States, future consolidations will likely be combinations of firms or business units headquartered outside the United States.

The major U.S. and Western European manufacturers sell products under multiple brand names. For example, Whirlpool sells products under 10 different brand names.

These multiple brands largely reflect the acquisition and merger history of the companies. The new industry entrants from Asia generally sell under one brand name, for example LG and Haier. However, the Asian companies also have many joint-ventures, crossholdings and unrelated product subsidiaries (for example, Haier Pharmaceuticals) that add complexity to their operations.

Competitive Forces
The companies in this industry face a number of competitive challenges, including selling into local and regional markets with multiple niches and incorporating new technology into mature products. These challenges are discussed below.
The global household appliances market generated total revenues of $121.3 billion in 2006. The global market for household appliances is expected to continue to grow, with an anticipated compound annual growth rate of 3.3 percent for the 2006-2011 period. Market growth in developed regions such as Western Europe, Japan and the United States will primarily be driven by replacement demand, as users both replace broken equipment and trade up to newer models. Because the life cycle of most white goods is more than 10 years, manufacturers will continue to introduce new technological innovations as a way to encourage upgrades. In developing economies, much of the new demand is from first-time owners of appliances.

The U.S. housing boom of the past several years helps produce revenue growth for the industry. The average house has six major appliances, so new housing is a substantial factor in total appliance demand. A softening in the new housing market creates a softening of sales in the appliance industry.

In mature markets, much of the sales growth is in the luxury end of the market, where consumers choose stylish products with expensive finishes. That segment is growing faster than 10 percent a year while the rest of the market is flat. Although the price of home electronics declines each year as advances in technology keep making them better, kitchen and laundry room appliances, which are now loaded with electronics, have defied the trend.

The U.S. appliance industry is a relatively mature industry, with a few companies producing a full line of major household appliances—cooking, refrigeration and laundry—and many more companies specializing in more narrow lines of product categories. There are also many companies that produce small household appliances. Recently, low-cost manufacturers from Asia (Haier, Samsung and LG Electronics) have introduced lines of major appliances.

U.S. consumers enjoy state-of-the-art household appliances at relatively low prices because of intense competition brought about by both domestic and foreign firms. About 50 percent of the domestic market in many appliance categories is made up of imports. At the same time, many major U.S. appliance manufacturers have a global presence. Overall however, the United States consistently imports more than it exports.

While the United States remains a key market for household appliance manufacturers, it is not considered a high-growth area for the industry. Still, it is a crucial player in the global industry because of the billions of dollars spent on imports in the household appliance sector.

Competitors are turning up the heat in the U.S. market through expansion investments.

Sweden’s Electrolux is expanding its refrigerator plant in Ciudad Juárez, Mexico. The project reflects the firm’s strategy of relocating work to lower-cost markets. BSH Home Appliances Corp. will add production of mid-priced dishwashers in New Bern, North Carolina, where it now makes high-end dishwashers. The firm is a subsidiary of the world’s third-largest appliance-maker, Bosch and Siemens Hausgerate GmbH of Munich, Germany. Chinese appliance-maker Haier Group Co. intends to build a second factory in Camden, South Carolina, where it now runs a small unit making refrigerators.

Increasing market share in Europe is a difficult task for U.S. and Asian firms because the various cultural differences, languages and even electrical standards in the region present significant challenges for any offshore company. Firms producing for Europe face the marketing challenge of trying to reach the most people in a way that is both economical and effective. Appliance manufacturers also must adapt to European demand for smaller and more efficient appliances.

China has grown into the world’s largest supplier of white goods. The nation takes advantage not only of its inexpensive labor pool, but also of favorable exchange rates, which make pricing of Chinese goods especially competitive. China is a leading producer in the refrigerator, washing machine and microwave oven segments, where products are exported to the United States, Western Europe and throughout Asia. Although overall appliance production is expected to increasingly shift toward Asia, Western Europe and the United States hope to remain major producers due to their technical proficiency.

China will soon climb to the top of the mountain as a consumer of major appliances. If Asia’s population were to achieve the same market penetration as that of the United States, Asian demand for refrigerators alone would top 70 million units per year. Demand for major appliances in China is expected to grow by about 4.5 percent per year to reach 138 million units in 2010, outpacing growth in most other parts of the world and overtaking the United States as the world’s largest major appliances market.
A key reason for this projected growth is the relatively low current penetration rate of most major appliances in China in comparison to other developed countries. The growth will be boosted by household formation rates and the replacement of the large stock of appliances put into use over the last 10 years. Rising personal income levels and urbanization of the country’s rural areas should further support the major appliances consumer market.

Major appliance manufacturers throughout the world are capitalizing on this rapidly growing Chinese demand and are selling and manufacturing in China. U.S. retailers also see China as a key region to sell major appliances and are opening and acquiring retail outlets in China.

As Chinese appliance demand grows, its rapid pace of exporting is expected to slow. Growth in exports will slow in part due to increasing competition in offshore markets from other low-cost producing nations, as well as the establishment of offshore facilities by some Chinese manufacturers. Offshore competition comes from countries such as Brazil, Turkey, Thailand and Vietnam.

Japan and Southeast Asia
Three Japanese companies — Matsushita, Toshiba and Hitachi — have historically controlled much of the Japanese and Southeast Asian market, with pricing power and distribution channel barriers that are hard to penetrate. These manufacturers may lead a wave of consolidations similar to those in the United States and Europe, as local markets mature and exports increase.

Research and Technology
Technology for household appliances has focused on four primary objectives. The first objective is to bring differentiation to mature products. The second objective is the development of more energy-efficient and environmentally safe appliances. The third objective is the development of "smart" appliances while the fourth is the development of materials that are more lightweight, durable and clean. An examination of these technologies follows.

Feature Technology
As the major appliance industry matures, manufacturers are having a difficult time keeping their products from being commoditized. U.S. and European manufacturers are attempting to delay, or permanently postpone, the commoditization of the appliance industry through the use of innovation. Much of the future product differentiation will come from incorporating new technology into appliances. For example, wireless technologies hold the potential for many innovations.

Future refrigerators might record inventory and automatically reorder when quantities are drawn below a preset threshold.

The new view that appliances are luxury items rather than simple commodities is impacting the life cycle of the machines. Eighteen percent of consumers in 2006 decided to upgrade appliances before the old model had worn out, almost twice the total from earlier in the decade.

Outside the desire to own the latest and greatest or the decision to enhance their homes, other appliance buyers are motivated by concerns over energy and the environment. The high cost of energy, coupled with growing interest in global warming and water conservation, have prompted some homeowners to replace older, less-efficient appliances earlier than in the past.

Premium appliance models generally carry higher profit margins for industry manufacturers. Conversely, lower-end models have smaller profit margins. Washers, dryers and refrigerators tend to be more profitable to appliance manufacturers than dishwashers and cooking equipment.

Energy and Environmental Technology
The U.S. National Appliance Energy Conservation Act of 1987 directed the U.S. Department of Energy to raise the environmental compliance standards for several types of appliances to meet tougher environmental goals. New energy efficiency standards were written for all types of appliances to encourage the use of more efficient motors, auxiliary water heaters, lower wash temperatures, reduced water usage, better insulation of components and heat controlled shut-offs. Refrigerators and freezers were the first to be targeted, but a 2004 law put more stringent standards on clothes washers. This has forced manufacturers to develop washers that use less water and, therefore, less energy to heat the water.

The efficiency movement also has accelerated the replacement of older appliances. The federal government estimates that the typical household spends $1,500 a year on energy bills and could save up to 30 percent, or more than $450 a year, with machines given the Energy Star rating by the Department of Energy.

The replacement of pulleys and gears with electronics and variable-speed electric motors also make these energy-efficient machines quieter. Washing machines use less detergent and water and they spin off the water so effectively that clothes take less time to dry; thus saving more money. The dual-evaporator system in refrigerators means fewer defrost cycles in the freezer as
well as less energy consumption. Sensors in washing machines can weigh the clothes and adjust the water level, while sensors in dishwashers can determine how much water is needed and can sparingly dole out the detergent. The energy-saving technology allows manufacturers to add features, like 25 different wash cycles, and then increase the price. That is why the most energy-efficient appliances end up marketed as premium-priced products.

Although research and development have long been important in developed markets like Europe and the United States, by mid-2004 they were also a growing concern in emerging economies like China. Factors such as energy conservation, performance and quality are quickly becoming more important to Chinese consumers.

Global demand for household appliances totals about a half-billion units, which is good for the industry but potentially hazardous for the environment. Not only do appliances consume energy but they also must eventually be discarded. The need to recycle used plastics is by itself a daunting task. In 2007, refrigerator disposal alone was estimated to yield approximately 125 million pounds of polyurethane foam and more than 200 million pounds of other plastics. Thus, the worldwide appliance industry is being encouraged and mandated by governments to increase the recycling potential of old appliances and their components.

**Smart Technology**

Smart appliances are unique in that they perform certain tasks automatically to streamline users’ tasks. The key to smart appliances is that they are networked and connected, either to the Internet or to a central computer system. Industry leaders naturally hope that the consumers will upgrade to appliances with new technology.

**Material Technology**

Dramatic advances in home appliance efficiency and ease of use have been made possible by tough, lightweight, corrosion-resistant modern plastics. The household appliance industry has increased its use of plastics from less than 1 percent of material content in the early 1960s to approximately 25 percent by weight and more than 60 percent by volume.

**Supply Chain Management**

Key material inputs to the manufacture of household appliances include energy, steel, aluminum, plastics and electronic components in the more sophisticated products. Suppliers are often reasonably large companies, but the relative lack of differentiation in these inputs weakens supplier power, as there are usually several possible sources for each. Furthermore, as suppliers and market players operate in very different businesses, the likelihood of vertical integration in either direction is usually low. Appliance assembly work is quite labor intensive and, in response, many major companies have established production sites in low-wage regions, such as the maquiladoras of Mexico. Transportation of finished goods can also be a significant cost that encourages manufacturers to produce appliances close to their major markets.

Despite industry consolidation, profits are still under pressure for a number of reasons. Higher commodity prices — especially steel — and increased transportation costs are driving up the cost of products. At the same time increased competition, particularly from low-cost Asian producers, are limiting price increases. The resulting profit squeeze is driving major manufacturers to move even more production of parts and components to competitive labor cost countries. However, due to the high cost of transporting finished appliances, final assembly is likely to stay close to major markets for the foreseeable future. To lower costs, manufacturers are aggressively moving production to competitive cost countries in Eastern Europe and Asia.

Appliance manufacturers have also placed renewed emphasis on increasing speed in delivery of products. Historically, most retailers held large inventories of appliances to ensure that they were able to meet customer demand when the market for household appliances was strong. However, this was expensive and conflicted with retailers’ interests in keeping overheads down. Retailers increasingly partnered with manufacturers to help them with the carrying costs of warehousing products. This trend triggered a surge in the use of appliance showrooms, where customers could place an order for an appliance and the product was shipped directly from the manufacturer to the customer the next day. To meet market demands, manufacturers have had to redesign and better integrate their supply chains.

**Conclusions**

More than 10 years ago, the industry began a globalization process when Electrolux of Sweden acquired White Consolidated Inc. of the United States with the Frigidaire, Kelvinator and White Westinghouse brands. This was followed by Whirlpool’s acquisition of Phillip’s European appliance business, and in 2006, Maytag. In Europe, Electrolux and Bosch-Siemens have acquired smaller manufacturers in to achieve dominance and market positioning. The industry consolidation has resulted in two global market leaders, Electrolux and Whirlpool. These companies have a strong presence in most of the important markets around the world. In
addition, there are several other manufacturers with a strong market position in one or more local markets. But the barriers to entry into household appliances are not prohibitive as evidenced by the growth of suppliers in Korea and China. Challenges include the cost of establishing manufacturing facilities and distribution networks, and the need to obtain economies of scale to keep costs low. Nonetheless, many of the manufacturers moving into foreign markets have found the competition much more intense and unremitting than they expected.

Global competition and incorporation of new technology into appliances will keep this industry sector consumer-friendly for the foreseeable future.

References
Note: Web references were accurate at the time research was conducted; however, researchers cannot guarantee URLs are still current.


www.roke.co.uk/download/brochures/Household_Technology.pdf
www.hoovers.com
The overall objectives of this research are to:

1. Determine how supply chain integration is being achieved internally and cross-enterprise.
2. Identify challenges that are encountered and how they are being overcome.
3. Determine the potential benefits resulting from enhanced integration of supply chains.

Given the complex nature of the issues being addressed and the fact that some aspects of the research were exploratory in nature, case studies were considered to be an appropriate methodology. This approach enables the collection of rich data, both quantitative and qualitative, and allows the flexibility to delve deeper into an issue when warranted. The study employs a modified grounded theory approach whereby an initial theoretical model is posited, based on a review of existing literature on supply chain integration, and the adequacy of that model is tested throughout the data collection process, resulting in a modified model that emerges from the data.

**Data Collection**

Our focus on integration, both within and across organizations, made it desirable to collect information from multiple organizations in the same supply chain as well as from multiple individuals within each organization. Our original intent was to collect data from “triads” of firms — a “focus” company plus one of its key suppliers and one of its key customers — in supply chains in several different industry sectors. Ultimately, we were able to collect data from two complete triads plus three more dyads (focus firm and key supplier).

An interview protocol was established before data collection, and semi-structured interviews were conducted with key personnel from the respondent firms. The Interview Guide is presented as Exhibit 1 below. Interviews focused on the supply chain touch points between functions and between enterprises. The goal was to gain insights into how alignment and linkage are achieved at these touch points (see discussion of the research model in Chapter 2.) Multiple interviews were conducted at each company in customer- or supply-facing activities, such as purchasing, requirements planning, logistics, product development, marketing, sales and operations planning.

Interviews typically lasted one to two hours, over one-to-two-day visits with a single company. Either two or three members of the research team were present for each interview. Interviews were not recorded, so the presence of multiple researchers in each interview session was critical to ensure that information was not lost or misinterpreted. In some instances, follow-up telephone contacts were used to confirm and/or clarify information. During and after data collection, detailed interview notes were cross-checked, formalized and organized into major categories, analyzed and interpreted.

**Firms in the Sample**

Our intent was to include focus firms in the study that could provide insights into effective strategies and practices for achieving supply chain integration. To that end, we wanted to include firms that had achieved some level of success at integrating their supply chains. We also wanted to examine supply chains in a variety of different industries to see whether market or industry characteristics had an impact on supply chain integration practices.
A review of the literature, including a review of several rankings of “world class” supply chain management firms helped us to identify 12 candidate firms. The candidate firms were pre-screened through initial telephone and personal contacts to understand the organization’s experience with supply chain integration and its willingness to participate in the study. A key element of a focus firm’s participation was their willingness to assist in securing the involvement of a key supplier and a key customer firm.

In total, data were collected from 12 companies in five industry sectors. The companies included five focus companies, two customers and five suppliers. The five industries included household appliance, consumer products, engineering construction, hospitality and semiconductor. We believe this sample provides a good range of business environments from which to collect data — both goods and services; both high- and low-volume businesses; both consumer and industrial customers; and a variety of competitive situations.
Exhibit 1

CAPS INTEGRATED SUPPLY CHAIN RESEARCH INITIATIVE
Interview Guide

Company Background

Characteristics of product(s)/service(s) selected as examples of leading-edge supply chain integration

Context
- Choice of customer and supplier where a significant level of supply chain integration has been achieved for the selected product(s)/service(s)
- Is this the only product/service for which you are integrated with this customer/supplier?
- Are there other customers/suppliers with whom you are highly integrated?
- What are the competitive priorities for this product/platform and the supply chain strategies you are employing to achieve those priorities?

General issues regarding integration in this supply chain
- What are the characteristics of “integration” in this supply chain, in terms of the degree of linkage, coordination, collaboration, trust, commitment, and alignment of purpose that has been achieved?
- In what parts of the supply chain for this product is greater integration needed/desired? Why?
- Are there parts of the supply chain where a lower level of integration is sufficient? Why?
- What are/were the critical factors in choosing customers/suppliers to integrate with?
- Who (e.g., your firm, the supplier or customer) drove the move toward greater integration in this supply chain? Why? (e.g., financial reasons, competitive strategy reasons, etc.)

Impact/Results
- What has been the effect of the integration in terms of changes in business processes and/or changes in decision-making processes?
- What supply chain performance results have been achieved through greater integration in this supply chain? What are the key metrics that have improved?
- For your organization?
- For the other members of the supply chain?
- For the customer(s)?
- What has been the impact on overall firm performance for your firm? (e.g., profitability, market share, etc.)
- How does the performance of this supply chain compare with other supply chains your firm is a part of?

Integration Strategies/Practices
What strategies/practices are being used/implemented to facilitate integration in this supply chain? How are the strategies/practices being implemented? What are the problems/barriers to effective implementation? How are these barriers being overcome?

Structure and Governance
- Is there one vision of supply chain integration held by all members of the supply chain? If so, how was this vision developed?
- How are the members of the supply chain encouraged to accept one common vision?
- Do cross-enterprise governing boards exist for key supply chain members and, if so, how do they function?
- What approaches are being used to develop trust and key “partner” relationships, and are “trust” and “partnerships” necessary?
- What have been the barriers to trust and relationship building, both internally and cross-enterprise, and how have these barriers been overcome?
- How are key supply chain performance metrics identified in the supply chain? How are metrics linked to supply chain strategy?
- What common performance measurements do key supply chain members for “X” use?
- How are risks and rewards shared by key members of the supply chain for “X”?
Information Exchange
- What approaches are used and what information is transferred between key internal and external members of a firm’s supply chain for “X”?
- How are appropriate levels of transparency achieved?
- What data and e-systems are being used to align and integrate the supply chain for “X”? (Internally and cross-enterprise)
- On which specific order fulfillment processes are these tools focused?
- What are the performance objectives for the implementation of these systems?

Collaborative Decision-making
- What approaches are being used to implement collaborative supply/demand planning, goal setting, and problem solving between organizations in the supply chain?
- How are these decisions linked to internal decision-making?
- What risk management approaches are being/have been implemented?
- How do the organizations in the supply chain cooperate/collaborate to manage risk?
- To what extent are internal and cross-enterprise teaming and co-location approaches being used, and how?

Integration in other key supply chain processes
- Is integration taking place in new product development/innovation processes in this supply chain, as well as customer-order fulfillment?
- Is integration taking place in after-sale service/support activities in the supply chain?
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