

# Proceedings of the Supply Chain 2020 Project's Industry Advisory Council Q2 2006 Meeting



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## Table of Contents

Supply Chain 2020 Project Background.....	1
Executive Summary .....	2
1. Review of the SC2020 Project, Dr. Larry Lapide, MIT-CTL.....	3
1.1. Progress in Phase I & II .....	3
1.2. Output .....	3
1.3. Working Project Approach .....	4
2. Supply Chain Taxonomies, Dr. Edgar Blanco, MIT-CTL.....	4
2.1. Member Companies' Supply Chain Characteristics .....	4
2.2. Other Taxonomies .....	6
3. Tour of UPS' Healthcare Facility .....	6
3.1. Value-Added Services.....	7
3.2. Fulfillment.....	7
3.3. Financing.....	7
3.4. 21 CFR Part 11 Compliance .....	8
4. Scenario Planning, Dr. Mahender Singh, MIT-CTL .....	8
4.1. Process .....	8
4.2. Scenarios as End-States, Not Paths.....	9
4.3. Taking Off the Blinders .....	9
4.4. The Big Unknowns .....	9
5. Supply Chain Strategy Development, Dr. Larry Lapide, MIT-CTL.....	10
5.1. Formal Strategic Planning.....	10
5.2. Tactical Planning .....	11
5.3. The Future.....	11

## Supply Chain 2020 Project Background

The Supply Chain 2020 (SC2020) Project is a multiyear research effort to identify and analyze the factors that are critical to the success of future supply chains. This pioneering project will map out the process innovations that will underpin successful supply chains out to the year 2020.

Initiated by the MIT-Zaragoza International Logistics Program, the global research project involves dozens of faculty, research staff, and students at MIT and other institutions around the world. Two advisory councils, the Industry Advisory Council (IAC) and the European Advisory Council (EAC), made up of supply chain executives from leading companies, are playing a crucial role in helping to shape the work and generate new ideas.

By looking farther into the future than most business research initiatives, the SC2020 project hopes to deliver practical advances on the design and management of future supply chains. The project also aims to help companies understand the forces that are changing supply chains so that they can be better prepared for the future. This work can create value in society through improvements in transportation, logistics, and supply chain management (SCM) practices.

SC2020 research is broad and far-reaching, and is designed to meet a series of objectives in several phases. The objective of Phase I was to understand excellent supply chains and the underlying strategies, practices, and macro forces that drive them. Leveraging what was learned during the first phase, Phase II and later phases of the research are identifying underlying principles and projecting the future using scenario generation and planning methodologies.

As well as leading to a better understanding of future successes in supply chain management, the work will highlight what actions organizations should take to help ensure supply chain success. The work will also identify "sensors in the ground" -- approaches to recognizing which of the many possible futures are occurring. Forethought about the future will help companies position themselves for the long-term and avoid ill-conceived emotional responses to future changes in the world.

The Quarter 2, 2006 semi-annual meeting of the IAC was hosted by UPS and held on June 22nd at its Health Care Facility in Louisville, KY to solicit insights from the corporate supply chain executives. The meeting had the following major agenda items:

1. Welcome and Update on the SC2020 Project (Dr. Larry Lapide, MIT-CTL)
2. Supply Chain Taxonomies (Dr. Edgar Blanco, MIT-CTL)
3. Lunch and Tour of the Health Care Facility (UPS Personnel)
4. Scenario Planning (Dr. Mahender Singh, MIT-CTL)
5. Supply Chain Strategy Development (Dr. Larry Lapide, MIT-CTL)

## Executive Summary

The SC2020 project seeks to determine the shape of supply chains in the year 2020 under various plausible future scenarios. In addition to looking long-term, the project will answer the question of how companies can manage risks and put sensors in the ground today to prepare for the future.

The sixth meeting of the SC2020 Industry Advisory Council (IAC) was hosted by UPS at its Health Care Facility in Louisville, Kentucky. The meeting provided a chance for MIT's research team to present results and solicit feedback from Council members at this juncture between the second and third phases of the three-year project. During the meeting, the group discussed taxonomies for supply chain environments, scenario planning, strategic planning processes, and toured UPS' healthcare logistics facility.

Dr. Larry Lapidé provided a brief recap of the project. To date, the researchers have studied a range of current examples of excellent supply chains, researched macro factors that may impact future supply chains, generated a set of core principles that underpin supply chain performance, and used scenario planning to create three scenarios. The project has already produced more than two dozen theses, working papers, and articles.

The researchers are now creating a taxonomy of supply chain environments to help classify current and future companies. This taxonomy will help determine how particular companies might respond to specific future scenarios and conditions. The commonalities and differences among companies will define the commonalities and differences in their responses to the future. At the meeting, the researchers asked IAC members about their organizations' characteristics. Members cited characteristics related to customers, relationships in the supply chain, properties of the product, management issues, future challenges, and the degree of stability or variability in the environment. Data from this and other sessions will be used in the bottom-up process of generating a taxonomy.

The participants also toured UPS' Healthcare logistics facility to learn firsthand about the special issues involved in handling pharmaceuticals and medical devices. UPS' 517,000 sq. ft. access- and temperature-controlled warehouse space provides a clean, FDA-regulated environment for supporting a range of logistics services to the healthcare industry. The regulations include both strict handling requirements, especially for DEA-controlled substances, and a host of specialized information systems processes to ensure compliance. UPS provides a range of warehousing, fulfillment, transportation, tracking, and even finance-related services.

SC2020 researchers are continuing to develop their supply chain scenarios by augmenting industry group discussions with one-on-one efforts with selected member companies and industries. The three scenarios -- called Alien Nation, Spin City, and Synchronicity -- reflect a range of plausible futures as determined by the relative dominance of government, markets, and communities. These scenarios encode end-states and avoid predicting the numerous unknowable technologies, events, and trends that can shift power balances among stakeholders. Rather, the point of the scenarios is to help companies see plausible but different futures so they can avoid being blinded by tactical concerns of day-to-day operations. IAC members discussed radical changes, such as car makers becoming more like build-to-order Dell or fashion-centric Zara, the impact of public versus private equity on companies' time horizons, and the future of China.

Finally, the group discussed how companies formulate supply chain strategy. IAC members ranged widely in their planning time horizons. On one extreme, a member described an intricate nesting of 10-year business planning, 5-year business investment planning, 3-year planning update cycles, and 1-year cycle of business activities. Other companies had a very tactical supply chain focus. In these companies, cost issues or other, stronger internal groups took the place of formal supply chain strategy development. This tactical, short-term focus was common -- surveys suggest that only one in three companies have a formally-planned supply chain strategy. Yet many participants believed that supply chain issues were rising sources of competitive advantage. Supply chain issues are coming to the fore in the minds of executives. Companies in the year 2020 may be far more strategic in their supply chain development processes.

## **1. Review of the SC2020 Project, Dr. Larry Lapide, MIT-CTL**

The SC2020 project seeks to determine the shape of supply chains in the year 2020 under various plausible future scenarios. In addition to looking long-term, the project will answer the question of how companies can manage risks and put sensors in the ground today to prepare for the future.

### **1.1. Progress in Phase I & II**

Phase I (year 1) delved into supply chain excellence by examining current examples of excellent supply chains to understand what makes them work so well. The first year also started looking at macro factors that might influence future supply chains, such as energy costs, demographics (aging workers), and green laws.

The second phase further developed the work on macro factors through the creation of scenarios, which were tested by three industry groups: the SC2020 European Advisory Council, a transportation event held at MIT, and executive training at MIT. The researchers also used their acquired knowledge of excellent supply chains to develop a set of core principles that govern supply chain operations.

### **1.2. Output**

To date, the SC2020 project has created a range of working papers, publications, and master's theses, including 16 theses covering 21 cases studies of supply chains in nine industries. An additional 5 theses compared and contrasted supply chain practices in nine industries. Other works include a master thesis on supply chain response to green laws, and articles on topics such as the linkage between operational and financial performance, benchmarking best practices, and the habits of effective supply chains. Courseware for two executive education workshops was also developed. The courses target the issues of strategic alignment of supply chains and scenario planning. Ultimately, after Phase III, the project will likely produce a book on the future of supply chains.

### **1.3. Working Project Approach**

The third and final phase of SC2020 will merge the first two phases of work by further developing the supply chain models and then running the scenarios through those models. One-on-one work with IAC member companies will help both the researchers and the participating companies to understand the impact of the scenarios on the supply chains.

Although the current plans call for only one group meeting (and many one-on-one sessions) during Year 3, several IAC members advocated additional group meetings to facilitate greater cross-fertilization and sharing of the project's results. The IAC members saw great value in hearing the issues and insights of members from other companies. Despite the companies' diverse industry contexts, they often share similarities that prove enlightening.

## **2. Supply Chain Taxonomies, Dr. Edgar Blanco, MIT-CTL**

The SC2020 effort will cope with the diversity of present and future businesses by creating a taxonomy that helps classify companies and industries in ways that are useful to modeling supply chains of the future. Although every company thinks it is unique, it is not. Just as whales and humans are both mammals, so, too, companies of seemingly very different industries and contexts may both share some characteristics.

For example, one telecom company recognized that its business was largely similar to that of UPS. An Internet network router bears a significant similarity to UPS' Louisville sorting hub: moving packets of bits is much like moving packages. Moreover, both companies have a wide range of similar business issues, namely service guarantees, delivery time requirements, sprawling IT infrastructures, rerouting for resilience, prioritization of traffic, massive asset networks, and ebbs and surges in customer traffic. To create its taxonomy, MIT researchers are exploring the characteristics that define the commonalities and differences between companies and industries.

### **2.1. Member Companies' Supply Chain Characteristics**

The key to constructing taxonomies is to identify those commonalities and differences that let a person judge whether two supply chains might have a common or different response to the future. To facilitate creating a taxonomy, Dr. Edgar Blanco of MIT-CTL asked IAC members to list five characteristics of their companies' supply chain environment.

When asked what this meant, Dr. Blanco offered intentionally vague instructions to Council members because he did not want to introduce any biases or preconceptions about which categories of characteristics might be germane. Dr. Blanco will use a variety of characteristics to construct a bottom-up taxonomy for the SC2020 project. Each IAC member provided his ad hoc list of characteristics. These characteristics grouped into several sets, are described below.

## **Customer Characteristics**

First, several IAC members described their supply chain's environment in terms of customer characteristics. These characteristics included qualities such as the customer value proposition (e.g., Caterpillar's customers wanting 100% uptime or Zara's customers wanting constantly changing fashion apparel). Other customer characteristics included after-market service or the need for reverse logistics.

Some Council members stressed the disconnect between a customer's characteristics and a company's supply chain realities. For example, on one hand, a customer might want to minimize inventory and get short lead-times on orders. On the other hand, a company might have long manufacturing lead-times or have a capital-intensive operation that requires high asset utilization. This discrepancy between the company and its customers may result in a disconnect between customer orders and manufacturing activities. Finally, some companies have high capital investments with very risky, unknown levels of future customer demand.

## **Relationship Characteristics**

Second, several Council members cited characteristics of the relationships that they have with other companies. Companies may have collaborative or adversarial relationships with their suppliers. In extreme cases, collaboration can occur between competitors, such as reciprocity agreements that help an industry share high-cost resources or provide better service. One example of this is the DoD-driven joint project by Boeing, Raytheon, and Lockheed Martin to create a next-generation missile system.

Related to collaboration is the nature of information flow in the supply chain, namely whether the information flow is push or pull. Relationships can also provide risk sharing, which can help mitigate the risks of materials shortages in high-utilization factories or the risks of cost or revenue fluctuations. For example, Blockbuster Video's revenue sharing with Hollywood studios helped boost revenues as well as profits for both parties.

## **Properties of the Product**

The properties of the product also affect the supply chain and could be used to define the commonalities and differences among companies. IAC members described varying degrees of intellectual property (IP) content in their products. They also varied in the degree to which each company creates physical versus virtual (service) goods, the rate of product obsolescence, and whether the products were high-value. In addition to these product descriptors, product cycle time challenges were also discussed. For example, one member company faced both long design-cycle times as well as short product life-cycles.

## **Management Issues**

IAC members mentioned management characteristics such as the metrics used to manage the company (e.g., return on assets). Management styles varied across companies, from very centralized to very decentralized with software-managed, self-learning networks. Companies also varied in the amount of automation they had, especially in terms of handling exceptions. In addition, companies differed in how (or if) they aligned supply chain strategy with general business strategy.

## **Stable vs. Dynamic**

Some Council members cited variability or rapid change as a key characteristic. For example, one company is seeing its industry shift from what were industrial products to more consumer-device-oriented products. Another cited process variability: the company must handle some 600 different types of exceptions. Companies differed from each other in terms of capacity and volume -- one had inflexible capacity while others experienced massive surges of volume that drove flexibility.

## **Other Considerations**

Finally, some Council members characterized the environment in terms of the key problems of today's supply chains. Common problematic processes included quotes and proposals, order acceptance, after-sales service, sourcing, and fulfillment. Visibility was also a major issue, especially for goods in transit. A lack of information, inconsistent information, inaccurate information, and difficulty getting timely alerts about delays can all affect companies' visibility of supply chain activities. Complexity exacerbates supply chain challenges due to the multitude of participants and hand-offs. Finally, some members cited other problematic issues, such as compliance with high levels of regulation and social/labor issues that constrain attempts to reconfigure the business.

## **2.2. Other Taxonomies**

MIT researchers also considered, and largely rejected, other taxonomies from the existing literature. For example, one taxonomy focuses on industry categories (e.g., high-tech, consumer goods, natural resources, etc.). Although useful for thinking about the commonalities and differences between companies, this taxonomy creates preconceptions that tomorrow's companies will retain the same industry-specific supply chain structures and characteristics as the world evolves, which is not even the case today.

Another taxonomy splits companies by the push/pull boundary with categories such as engineer-to-order, build-to-order, and make-to-stock. Although this taxonomy provides some insights, its limited focus on a single facet of operations -- the strategy for back-end manufacturing/fulfillment activities -- does not suit the broader needs of SC2020.

A third taxonomy splits the demand side into so-called functional versus innovative products. This split defines the dichotomy between supply chains that efficiently deliver a stable volume of unchanging goods versus responsive supply chains that deliver fast-changing, short-life-cycle goods.

## **3. Tour of UPS' Healthcare Facility**

The group toured UPS' healthcare logistics facility -- a temperature-controlled, 517,000 square foot facility in Louisville. The facility is part of an eight-acre logistics campus that has three million square feet of warehouse space.



### **3.1. Value-Added Services**

UPS offers a range of value-added services that differentiate the company from the low-margin business of commodity public warehousing. For example, UPS provides call centers, pick-and-pack, late-night end-of-runway expedited shipment, and FDA-compliant handling in a clean environment with three levels of temperature and humidity control. UPS also manages the transportation associated with the warehouse -- inbound/outbound, LTL/TL/refrigerated, back-hauls, and customs brokerage. The outbound shipments range from full trailers for a large healthcare distribution company to end-consumer shipments of medical device consumables (e.g., diabetes test strips). The healthcare supply chain is becoming more like the high-tech supply chain, with concepts like VMI, postponement and direct-to-consumer becoming more prevalent.

Handling healthcare products such as pharmaceuticals and medical devices involves a host of added constraints and requirements not found in the logistics processes of most other products. UPS must provide heightened control of cleanliness, temperature, and humidity, which makes the massive warehouse feel more like an air-conditioned big-box retailer than a hot, gritty industrial warehouse. Access control goes beyond that needed for high-value products, because the need to protect \$900-a-vial medications combines with strict FDA product-control regulations.

UPS also handles some DEA Class III and Class IV controlled substances, which adds a second layer of tighter control and security. Special secure cages inside the warehouse hold controlled substances and are protected by 24x7 video recording and sensitive internal motion sensors. Special access processes ensure that only authorized people can access the drugs and, even then, people must work in pairs.

### **3.2. Fulfillment**

UPS provides specialized pick logic needed for healthcare products. Depending on the customer's needs, the fulfillment logic might be First-In-First-Out or First-Expiry-First-Out. For some products, UPS provides fulfillment that is specific to the end-customer. For example, UPS will hold inventory of a specific lot of medical materials (e.g., medical lab materials) for a specific hospital. Shipping product from the same lot to the same hospital means that the hospital does not need to revalidate its equipment as often.

UPS uses information-augmented manual processes because the costs of automation would exceed the net benefits. Extensive use of optical barcodes help the company track products, packages, and locations in the warehouse. UPS has a separate cadre of quality inspectors in its healthcare warehouse and extensive ISO-9000-like quality methods, but it is not ISO certified.

### **3.3. Financing**

UPS, in general, also provides some financing functions (e.g., import/export financing) as part of UPS Capital, the company's captive banking arm. UPS can invoice when the shipment goes out the door and collect the revenues on behalf of its healthcare industry clients. UPS then sends

regular reports, via EDI or flat-file transfer, to the pharmaceutical makers and distributors who use the warehouse. UPS explicitly does not take ownership of the inventory it helps manage. Holding such a high-volume of high-value healthcare products inventory on UPS' balance sheet would create too much risk to UPS' AAA credit rating.

### **3.4. 21 CFR Part 11 Compliance**

Regulatory compliance issues include both FDA licensing and state pharmaceutical distribution licenses needed to ship to all 50 states. Beyond complying with all these regulations for handling the products, UPS provides electronic records compliance as part of 21 CFR Part 11 to prove it did what it said it did. This means proving that UPS can trace the healthcare products that it handled, that it handled these products safely, and that no one could tamper with the compliance data. UPS must track not just the quantities of items coming in, going out, or sitting on shelves, but it must also track the materials by lot number -- knowing which items are in inventory, not just how many items are in inventory. At any instant, the company needs to know where the medical products are and to whom they are going. Lot-number tracking ensures traceability in the event of a recall. These added information tracking tasks fit with UPS' strengths in logistics IT.

## **4. Scenario Planning, Dr. Mahender Singh, MIT-CTL**

SC2020's scenario planning efforts address the fundamental question of what supply chains will look like in the year 2020. A core part of the SC2020 effort is a scenario planning component that will define a set of scenarios.

### **4.1. Process**

SC2020 project is leveraging multiple resources to develop a set of three comprehensive scenarios after filtering them through a supply chain lens. The three scenarios are driven by the dynamics created by the relative power balance between three powerful forces namely, market, community, and government.

The first scenario is dubbed "Alien Nation" because of the highly fragmented world created by a complex interaction between local regulations created by governments and objectives and desires of communities. The second scenario is called "Spin City" and features a tussle between government and market forces. The final scenario is called "Synchronicity" projecting a very collaborative combination of community and market forces. Each scenario describes an internally consistent but different environment that can potentially challenge the underlying assumptions of current supply chain operations.

In exploring the supply chain implications of the three scenarios, SC2020 researchers have held three multi-company workshops to-date and going forward plan to do one-on-one scenario planning sessions with member companies. By intensively delving into the likely impacts of the three scenarios on specific companies, MIT researchers hope to add depth to their scenario

planning efforts. So far, three companies have shown keen interest in collaborating in these sessions.

## **4.2. Scenarios as End-States, Not Paths**

The three SC2020 scenarios represent broad-brush end-states that reflect the relative roles of markets, community, and government. As such, the scenarios do not attempt to predict the specific mechanisms, technologies, or geo-political events that might push the world toward any of the three scenarios. For example, the highly fragmented world of Alien Nation could arise from a pandemic, from rising global terrorism, from community-led anti-globalization laws, or from China's withdrawal from world trade. The point is that a well-constructed scenario does not need to predict the unknowable innovations or disruptive events of the future. Rather, the scenarios are about the "what" of the future, not the "how" of the future.

Moreover, the true rationale for scenario planning is the discussions fostered, not the predictions made. The scenarios need only to span relevant categories of exogenous outcomes. For example, sprinkled among the three scenarios are macro factor issues such as limits on natural resources (i.e., oil shortages), and worker shortages (e.g., the effects of aging). The scenarios will help both the researchers and the companies think about how companies might deal with different levels of fragmentation or global integration or how they might handle varying levels of regulation.

## **4.3. Taking Off the Blinders**

A group exercise illustrated the problem of human tendency to overlook powerful disruptions in certain situations. The audience was divided into two groups to watch a video in which numerous white-shirted and black-shirted people passed basketballs back and forth. One audience group carefully tracked how many bounce-passes occurred among the white-shirted players, and the other audience group monitored the bounce passes between the black-shirts in the video. After watching the video, both sides discussed their estimates of the numbers of bounce passes completed by the two groups.

Interestingly, the audience completely missed the most surprising element of the video. In the midst of the video, a man in a gorilla suit wandered into the small clutch of players, waved at the camera, and walked off. The audience was so focused on their predefined task that they missed the glaring but unexpected event that unfolded in front of their eyes. The point is that the tactical challenges of day-to-day supply chain operations and the prevailing strategic imperatives of a company can so absorb any management as to blind them to unexpected but powerful shifts transforming their world. Scenario planning can help organizations prime themselves for noticing the proverbial gorilla.

## **4.4. The Big Unknowns**

As part of the feedback process, the group discussed the potential for missing important events and developments. For example, the group wondered if scenarios of 10 to 15 years ago were

accurate -- that is, did any one of them look like today's Internet-driven, outsourcing-intensive, world? In some cases, the answer may be no. As one participant noted that British Petroleum created a set of scenarios that ignored the potential for the nationalization of oil resources such as is currently occurring in Bolivia. But, the more important point to be highlighted here is that the ability to predict future events is not critical to the success of the scenario planning exercises. In most cases, planning for a specific situation is not necessarily dependent on the knowledge of the underlying cause.

More generally, the group discussed the potential for dramatic changes. The point is that SC2020 means considering how companies can morph radically. For example, might car makers change to become more like Dell's build-to-order model or Zara's high-velocity fashion-retail model? Some companies are already experimenting with this. Daimler-Chrysler's Smart car has interchangeable body panels that let consumers pick one of 30 color schemes and drive away with their customized car in 20 minutes. Discussions about this suggested that car makers could be much more flexible than they think they can be.

Another factor that might radically affect companies' supply chain strategies is the characteristics of the sources of capital that support the organization as well as the corporate philosophy. On the one hand, the public equity markets drive companies toward very short-term, tactical financial goals -- hitting Wall Street's quarterly profit expectations. Such companies might choose short-term tactical performance metrics over long-term investment and optimization when crafting their supply chain strategy. On the other hand, private equity may be more patient. Similarly, there is a difference between Toyota's patient approach to supplier relations and the more adversarial supply relations engendered by many American automakers.

China also presented a great unknown on many dimensions. For example only 1% of the Chinese populace has a car, a fact which represents a massive opportunity for car makers and a potential strain on global natural resources. China's stability and future business environment is a critical factor. In the power structure parlance of the scenarios, China's government and businesses currently hold the upper hand over community concerns about the environment and other issues. But a rising middle class might shift this power balance and push Chinese government policy or business practices in new directions.

## **5. Supply Chain Strategy Development, Dr. Larry Lapid, MIT-CTL**

To gather insights about how companies perform supply chain strategic planning, MIT researchers asked IAC members several questions related to strategic planning: who does it, what is it used for, what are the inputs and outputs, is it periodic, etc. The responses varied widely.

### **5.1. Formal Strategic Planning**

One Council member described an intricate, interlocking combination of horizons in his company's strategic planning processes: a 10-year business planning process with updates every

3 years that drive both a 1-year cycle of business activities and a 5-year business investment planning cycle. The 10-year plan, which is guided by the top imperatives of the business, defines key organizational goals but does not include quantitative goals (e.g., market-share goals). The entire process takes place in a 3-D matrix of business units, processes, and functions.

Another member company does a 3-5 year horizon strategic plan on an annual cycle. The company also does long-term visioning exercises, but these exercises aren't formally tied to the strategic planning process. For this company and others in its industry, the supply chain is not a competitive differentiator. Thus, this member company completely outsources manufacturing and supply chain operations. Nonetheless, supply chain issues occupy about 1/2 day of the company's 2-day strategic planning talks. The resulting supply chain strategy decisions are then converted into tactical initiatives.

## **5.2. Tactical Planning**

Other Council members described supply chain planning processes that were much more tactical. One IAC member noted that his supply chain group has little say during strategic planning processes. The company is driven by the engineering and product development side of the business. Thus, this company's supply chain group must be reactive/responsive to upper-level directives on what product to make and where to make it.

Few companies have robust supply chain planning, and many limit their future horizons to a couple of years. Some companies do look further ahead to identify threats or disruptions and then implement low-risk hedging. More often, companies have very short-term planning horizons.

This lack of strategic planning in the supply chain is actually the norm. Surveys suggest that a scant one-third of companies have a supply chain strategy. Even companies that claim to have "strategic sourcing" programs are really just implementing tactical cost-cutting imperatives. In too many companies, the supply chain remains a marginalized back-office after-thought. Fewer than one in 10 supply chain organizations prepare an annual report for the CEO.

## **5.3. The Future**

Despite the current dominance of tactical thinking in supply chains, a number of IAC members were hopeful that companies will take a more strategic view of supply chains in the future. For some companies, supply chains are becoming a distinct source of value. IBM, for example, is even selling its supply chain expertise. Others are realizing that supply chains can be a source of competitive advantage and are starting to analyze competitors' supply chains for strategic and tactical insights. The point is that companies can do much more to "commercialize" the supply chain and meet the challenges of the future.