

Proceedings of the Supply Chain 2020 Project's
Industry Advisory Council
Q3 2004 Meeting



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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 innovations that 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 further into the future than most business research initiatives, the SC2020 project hopes to deliver practical breakthroughs 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 two phases. The objective of Phase I is to understand excellent supply chains and the underlying strategies, practices, and macro forces that drive them. Leveraging what is learned during the first phase, Phase II of the research will project 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 excellence. The work will also identify "sensors in the ground" -- approaches to recognizing which of the many possible futures is becoming reality. By thinking about the future companies can position themselves for the long-term and avoid ill-conceived emotional responses to change.

The second quarterly meeting of the IAC was held on September 15, 2004 via a two-hour web cast to solicit insights from the corporate supply chain executives. Also participating were faculty, staff, and students representing the MIT Center for Transportation & Logistics (MIT-CTL).

Participants discussed the progress being made in the SC2020 project and frameworks for researching today's excellent supply chains, according to the following agenda:

- Introduction including discussions of the project background, the IAC kickoff meeting, a UPS visit, and the European Advisory Council.
- Excellent supply chain research discussion
- Phase I research plans
- Wrap up

1. Executive Summary

MIT's Supply Chain 2020 research effort, initiated by the MIT-Zaragoza International Logistics Program, considers the question of what excellent supply chains of global companies will look like in the year 2020. This involves two key areas of understanding. First, researchers will study the relationship between supply chain design and the internal and external factors that influence a company's design choices. These factors include external macro-economic and business environment factors as well as internal innovation and technology-driven factors. Analyzing supply chain design across industries helps elucidate the relationship between the factors that dominate a particular business (e.g., customer demand, asset costs, labor, supply constraints, etc.) and the way in which well-run companies design and run their supply chains.

Second, the research will use scenario-planning methods in the context of a supply chain model to suggest the likely designs of future supply chains under different possible futures. Fifteen years in the future may bring potentially radical changes in business environment, technology, and macroeconomic factors. What happens to global supply chains if the price of fuel skyrockets owing to oil shortages? How might a consumer goods company design its supply chain if, by law, all packaging had to be shipped back to a recycling center? How might an apparel maker or consumer electronics firm deal with a world that has no low-cost producer countries such as China or the Philippines? Forethought about these and other potential changes will help managers guide their company into the future.

During the web cast meeting, participants discussed a framework for supply chain excellence that involves interplay of business strategy, operating model, operational objectives, and tailored business practices. They also discussed a framework for classifying supply chain operational objectives in terms of three types: customer response objectives, efficiency objectives, and asset utilization objectives. Depending on the industry, company, or product line, managers may emphasize objectives in one of these groups based on the business and competitive environment.

2. Frameworks

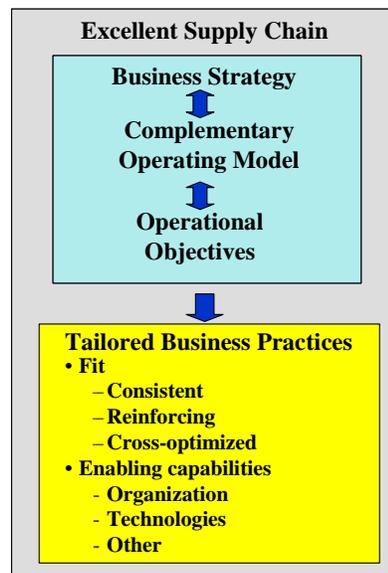
To help understand what will make supply chains excellent in 2020, we need to understand what makes them excellent today. The 2020 research does much more than just document best practices, because council members already have that data. Instead, the effort will map and model the relationship between the current range of best practices and the current range of underlying business and economic factors that drive the selection of those best practices. The proposed research will create a model that helps the researchers construct the likely properties of future excellent supply chains in the context of various alternative scenarios for the year 2020.

2.1. Strategies, Operating Models, Objectives and Practices

As discussed in the kickoff meeting of the IAC, excellent supply chains seem to have four characteristics. (See Figure 1) First, they support and enhance the strategy of the business. Excellent supply chains are integral to the overall design of the business. Second, the supply chain is part of a complementary, not necessarily unique, operating model that creates competitive advantage. Third, excellent supply chains emphasize high-performance execution, where performance is defined by a set of business-relevant objectives or metrics. Fourth, excellent supply chains leverage a tailored set of business practices.

Specifically, strategy, operating models and operational objectives are interrelated and mutually supportive. The tailored set of business practices, a subset of all possible business practices, are chosen to reinforce each other and for their ability to support the strategy, operating model, and objectives of the organization. The use of the term "tailored practices," rather than "best practices," reflects the alignment of the practices to holistically fit the context of the organization. This interrelationship is explored in Michael Porter's article "What is Strategy?" in the November-December 1996 *Harvard Business Review*.

Figure 1: Excellent Supply Chain Framework



2.2. Categories of Objectives: A Possible Model

Operational objectives represent a convenient way to think about how different companies run their supply chains. Objectives codify "what is important" -- those business variables or metrics that most strongly influence that company's performance. One approach to understanding supply chains is to examine the operational objectives used by each company involved. A possible model, described below, groups objectives into three sets.

Customer Response Objectives

Operational objectives such as order cycle time, perfect order fulfillment rates, quality, and new product time-to-market are all objectives that assess the external, customer-facing side of the company. Companies in industries with high-margin, short-lifecycle products often emphasize this set of objectives. These industries include pharmaceuticals, fashion apparel, toys, and computers.

Efficiency Objectives

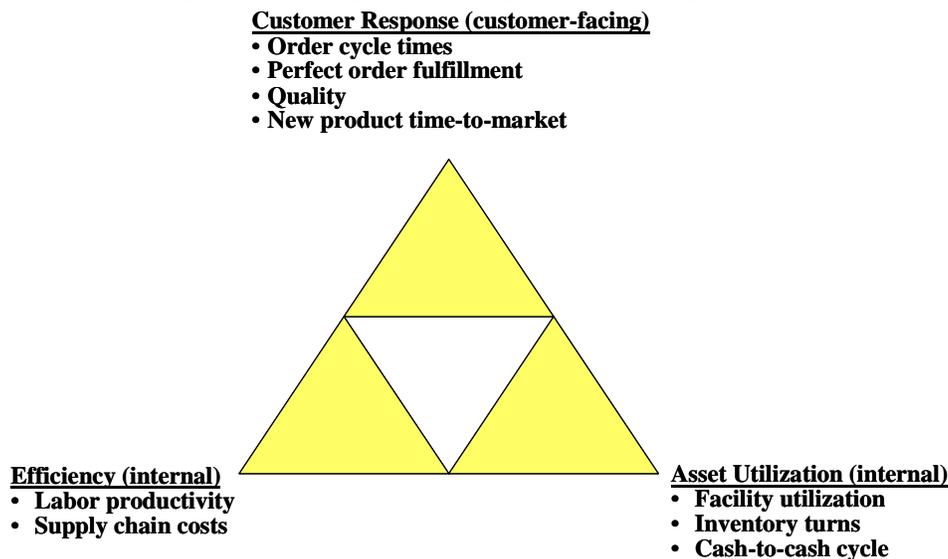
These operational objectives are internal measures that can assess how well the company converts inputs into output. Examples include labor productivity, labor content, supply chain costs, wastage, etc. Cost-conscious companies such as food and beverage, consumer electronics, non-fashion retail, and industrial supplies often focus on these types of metrics.

Asset Utilization Objectives

These operational objectives are also internal measures, however, they focus instead on how effectively the company is leveraging its assets such as facilities, inventories, and working capital (e.g., cash). Capital intensive industries, for example, such as semiconductor fabrication, petrochemicals, and commodity materials (steel, paper, coal) makers all try to make the most of their plant and equipment with 7x24 operations.

These three groups can be represented graphically through a triangle -- each group of objectives being a corner of the triangle. (See Figure 2) Within this diagram, companies and industries might reside somewhere in the triangular space. For example, a capital-intensive company, such as a steel-maker, might reside in the "Asset Utilization" corner of the triangle. Companies that combine objectives would sit somewhere in the middle of the triangle. For example, an airline might sit halfway between "Asset Utilization" and "Customer Response" because it both requires substantial assets and emphasizes timely service.

Figure 2: Categories of Operational Objectives



As various supply chain futures evolve or scenarios come to pass, companies might migrate, changing their objectives and thus changing their locations in this space. More importantly, IAC members stated that the focus on operational objectives could vary inside a company as well, possibly by business division, by product line, and even by individual product or within a product line.

In addition, companies could sequentially determine the weights or locations of the three objectives. For instance, if a product line needs to cycle through eight consecutive upgrades a year, then a company might put customer response as the first priority in its supply chain design to support frequent new product introductions and reformulations. Customer responsiveness would then drive asset utilization and efficiency objectives to support the primary objective. The prioritization of the objectives often manifests itself as a logical relationship among them, which is different from viewing and defining them in isolation. There would also be a dynamic and iterative process in determining the exact locations of the objectives.

At Dell, the foremost objective of the supply chain is to be demand driven -- responsive to whatever demand they get from end consumers. One simple operational metric Dell uses is the time from order entry to shipment the next day; this is a binary measurement, in that either the company makes it or not. From the supply chain perspective, the challenge is to ensure that material required is available since Dell is a build-to-order manufacturer. This lends itself to another metric Dell deploys, material availability on the shelf when an order comes in. Both metrics help drive Dell toward operating its supply chain as flexible as possible to satisfy customer demand, be truly demand-driven, and in a near real-time fashion.

A metric mentioned by an IAC member was the time from material procurement all the way to the shelf. The company adopting this metric finds that it provides a good indication as to whether its supply chain is operating according to design, and gauges how well its operations are matching up to the company's business strategy.

2.3. Other Frameworks for Objectives

The preceding model is but one possible organization scheme for objectives. Several of the council members argued for a greater role of strategic customer-focused objectives -- that the above particular grouping of objectives contained too many internally focused operational objectives and that they were short-term in nature. In the current business environment of 2004, customers' demands for low cost, fast response, good service, high quality, and individualized offerings seem to drive many facets of supply chain design.

2.4. Company Examples

By studying a diversity of companies in different industries, researchers hope to model the relationship between supply chain design and contextual business factors. This meeting included

a first-pass analysis of four companies used to illustrate the proposed excellent supply chain framework discussed above. Further research on these companies will help refine and validate the framework.

Wal-Mart

The strategy of retailing behemoth Wal-Mart is lowest-price retailing supported by an operating model of selling low-risk products and with the lowest cost-to-shelf. The tailored practices that help the company have low costs and offer low prices include automated logistics, large-format stores that leverage economies of scale, and co-managed inventory programs.

Dell

Best price-performance computer equipment is Dell's strategy. The operating model includes direct sales and customized bundles of standardized products. (Dell eschews traditional retail channels that both add costs and add delays). Tailored practices include BTO (Build-to-Order) fulfillment, co-managed-inventory supplier hubs, and back-end operations connected to the online sales front-end. The latter practice allows Dell to shape demand by "selling what they have, and not selling what they don't".

P&G

The consumer products giant uses a brand leadership strategy that has created 12 diverse brands with more than a billion in revenues each. Operating models that sustain these brands include new product innovation and a supply chain model that emphasizes shelf availability. Practices that support the models and strategies include a finely tuned product-upgrades process and cross-company coordination of promotions.

Cisco

This high-tech company has the strategy of being a one-stop shopping provider of networking equipment. Operating models include a well-honed model for acquiring technology-rich companies to add to Cisco's portfolio of products. An outsourced manufacturing model supports the production of Cisco's diverse product line, with an asset-light approach. Practices include supplier electronic connectivity and distributed order management that enables Cisco to coordinate very complex fulfillment activities.

2.5. Unit of Analysis: Industries, Companies, or Product Lines

Participants debated the proper unit of analysis: should the research look at supply chain excellence within industries, within companies, or within product lines? Although presented in terms of the best supply chain design for an industry or company, the realities of diversified companies mean that supply chain design may be product-line specific. One participant gave the example of General Dynamics, a company that makes Gulfstream jets for business executives, armored tanks for the U.S Army, and nuclear submarines for the Navy. Obviously, each division calls for its own supply chain design, with its own set of strategies and objectives driving it.

3. Scenarios

The Supply Chain 2020 project will rely heavily on scenarios for developing its models of future supply chain designs. A *scenario* is a self-consistent story of a possible future world. In the context of future supply chains, a scenario might define the potential future in terms of a host of external factors such as macroeconomic factors and relevant government actions (e.g., trade, labor, and Green Laws as well as a set of internal factors such as manufacturing technologies, distribution methods, information technology, and so on).

3.1. Developing Scenarios

Researchers plan to survey and leverage the scenarios created by others in the field. Thus, they plan to use an assemble-to-order process that draws on a literature search of scenario planning, futurism, and macroeconomic trends, as well as learn from others doing scenario planning.

A Small Set of Scenarios is Best

The researchers have already studied the scenario planning work of UPS, one of its IAC member companies. UPS described its efforts in scenario planning for 2017. The company found that it was too easy to become overwhelmed by all the dimensions and variables that might underpin a particular scenario. The company's managers uncovered 30 to 40 different dimensions that might have an effect on their business. If each dimension has a scenario with a high value as well as one that combines low and high values of the other dimensions, there might be billions or trillions of possible scenarios.

The company worked to reduce the number of dimensions. Of the initial 30 to 40 dimensions, it found that a dozen were critical variables that could have a major impact on the company. Even this seemed intractable. Ultimately, the company narrowed its list down to just two business-critical dimensions, resulting in a total of four scenarios. These scenarios were chosen both for their tractability and for their high relevance to the company.

Forethought, But Not Forecasting

When using scenario planning, companies don't need to predict the exact future. Rather, the scenarios provide forethought on the range of possible business-relevant contingencies. For example, Royal Dutch Shell promoted the popularity of scenario planning when it deftly handled the Arab Oil Embargo in the 1973. Shell did not predict the event, but the company had a contingency plan for its occurrence (as well as for other possible futures). When the Oil Embargo occurred, the company knew what to do. By discussing possible futures, managers can avoid emotional, knee-jerk responses if the scenarios come to pass.

3.2. Possible Scenarios

IAC meeting participants discussed some potentially relevant scenarios. These scenarios are not necessarily part of the final list that will be used in the research, but they serve as a starting point to discuss the issues and to uncover other, potentially more relevant, scenarios.

Oil is \$100 a Barrel

Energy plays a major role in the supply chains of many companies. Fuel costs affect transportation costs for many and can affect manufacturing costs for some (e.g., energy-intensive processes such as making steel or aluminum). For cost-sensitive companies, transportation fuel costs could affect the design of their supply chains by shifting them toward more distributed regional supply and manufacturing centers that reduce the distance from supply to customer.

The China Question

China also seems to feature prominently in the scenario planning minds of some companies. China represents a dual opportunity, both as a low-cost supply base and as a new outlet for sales. One participant suggested two divergent outcomes for China. On the one hand, China might grow to become the dominant economy in the world. Its developing industrial power and expanding middle class could spread from the industrial centers on the coast to encompass the 1.3 billion people of that country. On the other hand, China might implode from the stresses of development, civil unrest between the richer and poorer parts of the country, or corruption in financial or governmental systems.

This discussion of China raised two issues. The first was the potential evolution of China from low-cost producer nation to a higher-cost consumer nation. What will companies do to satisfy the consumer's insatiable desire for lower prices if wages in China grow? Might the locus of low-cost production shift to Africa or could it revert back to modest-cost regional production centers such as Mexico? The second issue was the ongoing tension between low-cost production in distant countries versus fast, responsive supply chain operations. What do excellent supply chains look like when geographic distances are large, but time and service requirements are tight?

Green Laws

Growing environmental awareness and regulation, especially in Europe, could change supply chain design. Governments and consumers are becoming more concerned with the total lifecycle costs of products and their environmental impact. Green laws could drive the need for ISO 14000 certification, better control of material content, and increasing use of reverse logistics for end-of-life products and packaging. As part of the Supply Chain 2020 project, a graduate student at MIT is currently researching the best practices of three industries that are currently impacted by these laws: recycling of automobiles, recycling of electronics equipment, and consumer packaged goods "green packaging."

Rise and Saturation of RFID

As RFID comes into broader usage, it may change how supply chains are run. In the near-term, many companies will create supply chain excellence and competitive advantage through effective deployment of this new technology by providing new levels of cost-effective supply chain visibility, customization of products and services, or through improved control over inventory and flows. By 2020, however, RFID may become passé -- providing no competitive advantage because it is ubiquitous.

Other Scenarios

Many other scenarios are possible. For example, extrapolations or reversals of current-day trends might suggest new scenarios. Although looking at trend lines can help find plausible scenarios, the Supply Chain 2020 initiative will not extrapolate those trends to make predictions, since accurately forecasting 10 to 15 years out is virtually impossible. Rather, the research effort will focus on a few well-chosen scenarios and their impact on future supply chains.

4. Project Process

The Supply Chain 2020 three-year effort follows an overall plan of observing in the first year, modeling in the second year, and analyzing in the third year. The first year emphasizes studying excellent supply chains of today. The first year also includes work on identifying some macroeconomic factors that might most affect supply chain design. The second year will see the development of macro-factor scenarios and the creation of a supply chain model. In the third year, the researchers will finalize the supply chain scenarios and analyze the likely impact on supply chain designs in 2020, and the implications for corporate action today.

4.1. Accomplishments

To date, Supply Chain 2020 has already reached several milestones. Researchers completed a literature search of the future of supply chains. A thesis on scenario planning was completed, as was a thesis on Wal-Mart's supply chain governance processes. Ongoing work is addressing topics such as the supply chain response effects of Green Laws, retail assortment planning, and a study of logistics parks and manufacturing hubs in developing countries.

SC2020 also held a kickoff meeting of the European Advisory Council (EAC) in Madrid in September 2004. Although the core IAC consists of global companies, Supply Chain 2020 created the European council to further enhance the initiative's global scope. Proceedings of the EAC kickoff meeting have been produced.

4.2. Next Steps: Leveraging The Council's Expertise

IAC's participation in Supply Chain 2020 is based on mutual sharing of knowledge. The researchers have the methodologies and resources to study this business issue, and IAC member companies have the specific knowledge and insights about their respective industries. By having

Supply Chain 2020 researchers working with IAC members, more accurate insights into the future of supply chain design can be gleaned. In particular, IAC members can improve the results of the initiative for their companies in three areas.

Discussing Scenarios and Supply Chain Design

Some of the council members advocated an earlier stage of discussion about future scenarios. This discussion would jump-start the process of thinking about the design of supply chains under different alternative futures. This is consistent with the current plan, and the upcoming Dec. 9th meeting of the IAC will include this issue.

Sharing Business Metrics and Practices

The council represents a wide span of companies and industries -- from raw materials makers to consumer packaged goods to semiconductors to computers. One recommendation was that at the Dec 9th meeting IAC members would share their models and operational metrics. This would help the researchers and the IAC understand the breadth of business models and chose a framework that lets them encompass the gamut of supply chain design alternatives.

Case Study Companies

The Supply Chain 2020 project plan calls for researching up to 10 industries and corresponding companies to populate its models for excellent supply chains. IAC members span many industries, including: high tech, telecommunications, natural resources, aerospace, automotive, pharmaceuticals, retail, apparel, consumer products, and distribution. The research will include collecting information on the strategies, operating models, objectives, and tailored business practices of selected supply chains. IAC members will be working with researchers on these case studies in their relevant industries, mainly to augment public data and commentary on these companies.