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## **Understanding the Lean Supply Chain: Beginning the Journey**

2005 Report on Lean Practices in the Supply Chain





## Table of Contents

<b>Executive Overview</b>	1
<b>Understanding the Methodology</b>	2
<b>Research Methodology</b>	3
<b>A Look at Lean</b>	4
<b>Attributes of a Lean Supply Chain</b>	10
<b>Point of View</b>	21
<b>In Summary</b>	23
<b>The Authors</b>	25
<b>About APICS, Georgia Southern University, Oracle, and Supply Chain Visions</b>	26



## Executive Overview

APICS, in conjunction with Oracle Corporation, Georgia Southern University, Supply Chain Visions are pleased to present this report drawing from the results of our 2004 survey on the development and adoption of Lean principles in supply chain management. The study highlights six drivers of the Lean supply chain.

Lean manufacturing's impact on businesses today cannot be ignored: Lean principles have enabled firms to be more flexible and profitable. Yet, to truly be Lean, these principles have to be extended beyond the bounds of the normal manufacturing process. This has led many to attempt to identify the key principles of Lean that apply to the supply chain, as well as how these principles should be adopted to build adaptive, flexible, and creative supply chains.

That Lean and supply chain management should begin this merger should not come as a surprise. Supply chain professionals the world over have been tasked with reducing waste, increasing turns and building greater flexibilities into their supply chains. Some of these areas overlap Lean. The purpose of this report is to clearly articulate the key attributes of the Lean supply chain. In addition, this report provides clear benchmarking data as to the current state of the Lean supply chain.

Six major attributes of the Lean supply chain are presented in this report: demand management, cost and waste reduction, process standardization, industry standardization, cultural change, and cross-enterprise collaboration. Each attribute will be defined and clearly benchmarked.

While the concept of Lean manufacturing is not new, it is clear from our survey results and case studies that many organizations have yet to transfer this learning to the supply chain. Yet, while the adoption rate is low, the benefits are seen to be quite high. Participants who were Lean adopters reported improved collaboration, an increased use of standards in processes and materials, reduced SKU counts and inventory levels, and a general reduction in cost of goods sold when compared to the nonadopters. A Lean supply chain is contributing to the bottom line.

Yet, more needs to be done. There appears to be a perception that Lean applies only to manufacturing processes. Others see Lean, total quality management (TQM), and Six Sigma as competing philosophies, rather than a complementary set of tools to enable the organization. We hope this report will help create a better understanding and promote a dialogue regarding the benefits of Lean between supply chain partners.

This research, and the resulting report, would not be possible without the continued support of the study's participants. We would like to thank these professionals for taking time out of their busy schedules to share with all of us their expertise and insights.

We hope you find this report helpful as you continue the process of devising, reviewing, and improving supply chain management initiatives within your company. They all should be evaluated against the end goal of an adaptive cross-enterprise supply chain—one whose efficiency is matched by its effectiveness.

Sincerely,

Karl B. Manrodt, Ph.D.,  
Georgia Southern University

Jeff Abott,  
Oracle Corporation

Kate Vitasek,  
Supply Chain Visions

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APICS continues to collaborate with industry leaders to deliver leading-edge inventory and supply chain management information. Such collaboration does not represent an endorsement of a particular company, methodology, or solution, but rather it demonstrates APICS' efforts to provide you with insight into current issues and emerging trends.

## Understanding the Methodology

Results of the study have been arranged in four sections. We start with a brief overview of the research methodology, as well as the steps taken to complete the work.

The second section is an overview of Lean manufacturing. This section is designed for those who may not be familiar with the basic concepts of Lean. Each of these concepts is defined from the supply chain perspective.

The third section describes and defines the six attributes of the Lean supply chain, and provides the results of our analysis. Each of the six attributes has multiple dimensions, which are also discussed.

Finally, we conclude with our “Point of View,” which highlights the authors’ perspective on the results of the past year’s work. The authors suggest future direction for achieving the Lean supply chain.

## Research Methodology

As this is the first in a series of reports on the Lean supply chain (LSC), the research team conducted a significant literature review regarding Lean principles and how they were being adopted in the supply chain. Based on the literature review, as well as discussion with Lean experts within Oracle, a set of key attributes for the LSC were developed, and they form the basis for the survey instrument.

Using an e-mail invitation in August 2004, APICS asked 5,806 of its members to participate in the online survey. Of those, 608 members participated in the study, which is a 10.5 percent response rate. Given that on-line surveys of this type normally have a response rate in the single digits, the level of participation exceeded our expectations. The large sample allows us to reach conclusions with a high level of confidence.

In addition, we conducted interviews with a select number of companies who were known to be progressive in terms of implementing Lean practices and had begun to work on Lean initiatives with supply chain partners.

### Participant Profile

As would be expected from the membership within APICS, more than 71 percent of the respondents are in manufacturing. With respect to business size, 70 percent of the respondents had annual sales under US\$1 billion.

One of the basic assumptions we tested immediately was that size and type of firm would have an impact on our results. In other words, large firms would be significantly different than smaller firms, or some industries may be farther along the Lean journey than others. Although we did find some differences, they were not as widespread as one might imagine. In other words, no industry group appeared to be leading the race for an LSC, and smaller and larger firms were about the same on adopting LSC principles.

Figure 1 — Total Annual Sales of Respondants

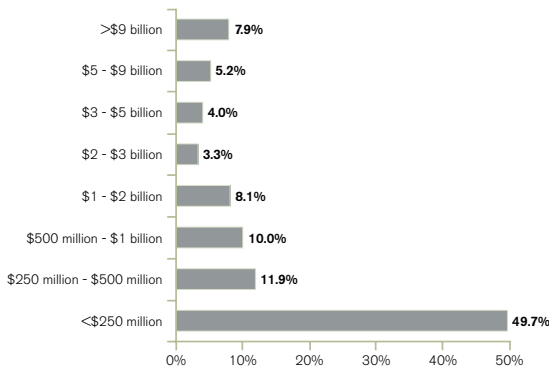
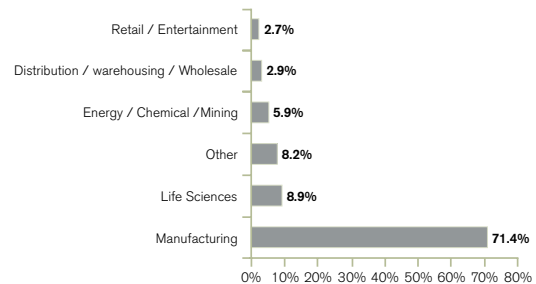


Figure 2 — Type of Industry



## A Look at Lean

### Driving the Change

To say that we live in a dynamic environment is an understatement. The way business was conducted even five years ago is evolving. So too are the means and methods of competition. This has led to traditional manufacturers shedding their plants and relying on domestic and international contract manufacturers. The supply chain has lengthened and grown more complex. Today's organization tends to be "horizontally integrated," with geographic locations performing only the "core" function and all other needs outsourced.

The power of Lean is amplified by merging it with complementary tools, and using its principles throughout the supply chain.

This complexity comes with a new set of problems. How do you deal with a global supply chain, while retaining speed and flexibility? How can waste be eliminated across the supply chain—and not just at one point in the system? How can firms collaborate in a way that is fair? How do you meet the needs of a global customer without excessive work in process or inventory held along the way? And, most importantly, how do you do it when shrinking margins are becoming permanent?

To tackle these problems, firms are adopting new methods of managing their activities. Reengineering, TQM, Theory of Constraints and Six Sigma come to mind. Lean manufacturing, though practiced for several decades, is now being leveraged across the firm, and not just limited to the plants. The power of Lean is amplified by merging it with complementary tools and using its principles throughout the firm.

### A Primer on Lean

Lean is a systematic approach to identifying and eliminating waste (non-value-added activities) through continuous improvement by flowing the product at the pull of the customer in pursuit of perfection.

The very basic concept of Lean started with Henry Ford in the 1920s when he applied the concept of "continuous flow" to the assembly line process. This practice focused on cost reduction by improving quality and throughput, and it continued to be recognized as the most advanced manufacturing process until two Japanese executives at Toyota introduced the Toyota Production System (TPS) after their visit to Ford in the 1950s.

As Toyota soon realized, optimizing a part of the process is different from optimizing the whole. If real changes were to take place, they had to include suppliers and customers. Without all of the key players, the timing and quality of goods by supplier will continue to impede manufacturer performance. This is the fundamental start for the Lean Supply Chain.

During the 1980s U.S. businesses were reintroduced to the importance of total quality management. While W. Edwards Deming was a visible player in this arena, he was not alone. Bill Smith, a senior engineer and scientist at Motorola, built on these concepts and developed Six Sigma, which is a standardized way to count defects in a process. Six Sigma's goal is to define processes and manage those processes to obtain the lowest possible level of error—as such it can be applied to virtually any process, not just manufacturing. It is well regarded in quality settings and subscribers are frequent winners of the Malcolm Baldrige award. Because of its emphasis on quality, Six Sigma and Lean are often paired together in the manufacturing environment.

Six Sigma was not the only method employed to focus on processes in the 1980s. In 1986 Eliyahu M. Goldratt published *The Goal* to describe the Theory of Constraints (TOC). TOC focuses on processes with the goal of understanding bottlenecks that govern the true rate of production, and it recognizes overall costs and service levels are more important than those of a single business unit or department.

Another landmark event occurred in 1991; this was the conclusion of a five-year study of TPS by MIT. One of the results was renaming and repositioning TPS as “Lean manufacturing.” The term Lean is derived from benefits over traditional mass production systems including less effort, less space, fewer defects, less throughput time, lower volume requirements, etc. The system is “Lean” because it can do more with less.

Lean manufacturing leverages TQM, Six Sigma, and TOC to reduce excesses throughout the manufacturing processes. This focus on eliminating excesses brings to light many wasteful processes and practices, allowing for cost reductions, quality improvements, and, when coupled with a customer-first policy, enhanced customer satisfaction.

Finally, there does appear to be some contention as to how Lean manufacturing should be viewed. Some think of it as a set of tools, others as a system whereby a company can reduce costs while at the same time increasing customer satisfaction. A third group views Lean more as a philosophy that emphasizes the minimizing the resources used in an enterprise.

Figure 3 — The Lean Continuum

A Set of Tools	A Philosophy	A System
<p>Lean is like a toolbox full of tools and techniques. You select the right technique or method to improve what needs improving.</p> <p>Dough Howardell, Lean Enterprise Institute</p>	<p>A philosophy of production that emphasizes the minimization of the amount of all resources used in the various activities of the enterprise.</p> <p>APICS</p>	<p>A system where a company can achieve reduced costs, coupled with continuous improvement and customer satisfaction which used a standardized 5-step approach.</p> <p>Lean Thinking</p>

Lean is all of the above. Success depends on how a company best implements the principles to achieve their needs.

Which view of Lean is right? From our perspective, all three have value. Lean does provide a set of tools that will enable firms to remove waste. It is useful to view Lean as a system, in that it helps firm focus on process that impact the final customer. And, it is helpful to view Lean as a unifying philosophy that is not limited to the manufacturing process. The greatest benefit of Lean will come by identifying the key attributes of Lean and applying them across functional boundaries, as well as the boundaries of other firms.

### Five Lean Principles

1. *Value*. Define value from the perspective of the customer.
2. *Flow*. Understand the process and clear any obstacles that don't add value.
3. *Pull*. Initiate work only when requested by the customer.
4. *Responsiveness*. Be responsive to change.
5. *Perfection*. Continuously refine the process to improve efficiency, cycle time, costs, and quality.

**A Primer on Supply Chain Management**

Where does Lean fit in logistics and supply chain management? Perhaps the best way to start is to define the terms and understand the how Lean fits into both areas.

The Council of Supply Chain Management Professionals (CSCMP) defines logistics as “encompassing the activities involved in the forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption.” Supply chain management is much broader, in that it “encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies <sup>1</sup>.”

From a practical side, logistics is focused on the activities noted above within a single firm. A supply chain consists of the same processes, but it views these processes over multiple firms. The former is internally focused; the latter externally focused. As noted in the table below, there are several areas of overlap between the two areas.

Table 1 — Comparing Lean and Supply Chain Management

Lean Production/Manufacturing	Supply Chain Management
Focuses on reduce waste and non-value-added activities	Goal is on reduced lead times/cost through various methods
Traditionally focused on success with primarily optimizing shop floor	Focuses on optimization across supply chain partners
Uses a set of structured tools	Applies Lean tools as well as leveraging other tools (Six Sigma, TQM, TOC, etc.)
Emphasizes on no inventory through “continuous flow”	Emphasizes on minimizing inventory through various techniques

For Lean to truly be effective, and to take cost/waste out of processes, it must focus on the entire supply chain. Optimizing the components of a process does not necessarily mean the entire supply chain will be optimized. Doing it right can have an advantage. According to Bob Trebilcock, Lean manufacturing and distribution can lead to

- Reduced cycle times;
- The ability to deliver every time at the same cost to the business;
- Predictable throughput times from better labor utilization;
- Improved working capital positions from reduced inventory;
- Lower warranty and customer service costs from improved quality. <sup>2</sup>

<sup>1</sup> The Council of Supply Chain Management Professionals

<sup>2</sup> “Lean & Mean,” by Bob Trebilcock, Modern Material Handling, March 1, 2004

“Manufacturing is not what it was. Today it’s difficult to say where manufacturing stops and logistics and distribution begins.”

*William D. Freidman*  
*Executive Director*  
*Ports of Indiana*  
*trafficWORLD*  
*September 27, 2004*

*Logistics* focuses on the activities of a single firm.

*Supply chain management* focuses on activities of multiple firms.

For our purposes, we define the Lean supply chain as “a set of organizations directly linked by upstream and downstream flows of products, services, finances and information that collaboratively work to reduce cost and waste by efficiently and effectively pulling what is needed to meet the needs of the individual customer.”

But what does it mean to be effective and efficient? What are the areas of overlap between Lean manufacturing and supply chain management? How should manufacturing and supply chain professionals respond to the challenge? What do they focus on?

Building and maintaining a Lean supply chain will revolve around six key attributes. Mastering these will lead to a Lean—and effective—supply chain. These key attributes are discussed in detail after a discussion of where Lean has been applied in the firms.

### Setting the Stage for Lean

Respondents were asked if TQM, Six Sigma, or Lean had been applied in various areas within the firm. Respondents could check each area multiple times; interestingly, respondents typically checked more than one philosophy for each area.

Table 2 — Key Philosophies Implemented Today

Area	Number of Respondants	TQM	Six Sigma	Lean
Raw materials inventory	518	30.3%	15.3%	54.4%
Finished goods inventory	516	31.0%	16.7%	52.3%
Transportation—inbound	247	31.2%	17%	51.8%
Warehousing	378	32.8%	15.6%	51.6%
Transportation—outbound	261	34.9%	16.9%	48.3%
Order management	322	34.5%	19.6%	46%
Manufacturing	793	32.7%	22.3%	45%
Forecasting	235	34%	21.3%	44.7%
Customer management	294	41.8%	23.8%	34.4%

### A Lean Supply Chain Defined

A set of organizations directly linked by upstream and downstream flows of products, services, finances and information that collaboratively work to reduce cost and waste by efficiently and effectively pulling what is needed to meet the needs of the individual customer.

Within the survey group, manufacturing has the highest rate of application of these philosophies in aggregate, followed by raw materials inventory and finished goods inventory. The forecasting, customer management, and transportation areas saw the least incidence of application.

Clearly, all three of these philosophies are seen to have more applicability in the management of production and inventory control processes. The survey group does not appear to believe, as seen by their adoption rates, that the three tools have significant applicability in transportation, forecasting, or customer/order management. In summary, there has not been much activity related to application of these philosophies outside of the enterprise in the extended supply chain.

One of the findings that surprised the research team was the number of respondents that are attempting to implement Lean into some aspect of their supply chain. As shown in Table 2, four of the nine areas had responses greater than 50 percent as related to the adoption of Lean, and Lean was the most popular tool or philosophy used in eight out of nine of the areas.

A closer examination of the table provides further understanding. It appears that the findings may actually provide a road map for introducing the concepts of Lean into the supply chain. Given manufacturing’s proximity to both raw materials and finished goods, it would seem logical that Leans influence would be felt in these areas. As logistics responsibilities move farther away from the manufacturing function, so too does Lean’s influence on the supply chain.

Table 3 — Implementation of Lean Percent of All Respondents

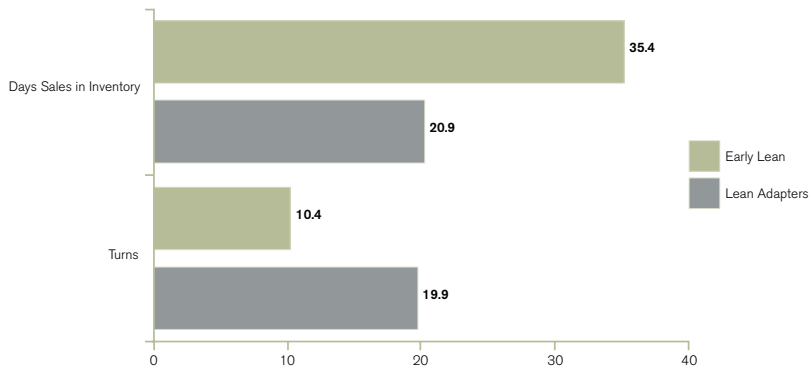
12.7%	47.4%	25.3%	9.0%	5.7%
<ul style="list-style-type: none"> <li>• Company has implemented one or two tools of Lean to learn more about its impact on the company</li> </ul>	<ul style="list-style-type: none"> <li>• Some Lean tools are implemented sporadically across the organization</li> <li>• There is no formal integrated implementation approach</li> </ul>	<ul style="list-style-type: none"> <li>• A formal integrated approach to implementation has been developed and is being rolled out</li> <li>• Awareness training is being performed at the operator level</li> </ul>	<ul style="list-style-type: none"> <li>• Entire product flow is integrated, product flows smoothly through out the facility</li> <li>• SC Partner companies are becoming involved in joint Lean practices</li> </ul>	<ul style="list-style-type: none"> <li>• Lean production is standard procedure</li> <li>• Continuous improvement activities are driven by the operators with management’s support</li> </ul>

**Why Be Lean?**

In addition to defining the attributes of Lean, the research team segmented the sample into three groups. On the lower end of the scale were those respondents who had not implemented Lean nor had any formal integrated approach to Lean. This group consisted of approximately 60 percent of the sample and will be referred to as the “early Lean” group. In the second group were the Lean adopters, who had integrated their product flow and were working with supply chain partners to become more Lean. Lean adopters made up approximately 15 percent of the sample. The third group was in the middle, and they were moving from an internal focus on Lean to extending this approach with suppliers and customers. Comparisons were made between Lean adopters and the early Lean group.

Significant differences were found between early Lean and Lean adopters. These differences will be noted in the section below. Most importantly, differences were found in how they performed on key logistics attributes: inventory turns and days sales in inventory. As the figure below indicates, Lean adopters had statistically significantly higher inventory turns, as well as lower days sales in inventory on hand. These differences not only reduce the cost of costs sold, they also dramatically impact the firm’s ability to be responsive to changes in the overall supply chain, as they do not carry excessive levels of inventory.

Figure 4 — Benefits of a Lean Supply Chain



Note: Gray bars represent early lean respondents; blue bars represent lean adopters.



## Attributes of a Lean Supply Chain

What makes a supply chain Lean? Based on our research, we have identified six key attributes that will lead to a Lean supply chain.

### Improved Demand Management

One of the key principles of Lean is moving to a pull system. That is, products or services are pulled when requested by the final customer. In its purest form this would be developed using data from the point of sale and conveyed upstream to all members of the supply chain from point to point without a change in the volume.

Clearly the end-user requirement for the finished product will generally be meaningless to a third-tier supplier, as they likely only provide a fraction of the materials for the finished product and most probably do not understand how they contribute to the end-product structure. Therefore suppliers at each level of the process must receive the customer's demand signal and convert it to something usable (part number and quantity) to their upstream partners. From a supply chain perspective, this can be rather difficult. How can the demand signal be sent from the end customer all the way back through the supply chain?

The consequences of not managing the demand signal are clearly documented. They are often referred to as the "bullwhip effect," where additional units are added to the original demand signal as the signal moves farther upstream. For instance, an order may grow 10 percent at each node as it moves from the retailer to the distributor, then to the manufacturer, its tier-one supplier, and their suppliers.

A Lean supply chain will work to have products pulled through the channel using customer demand from point-of-sale systems (POS) in real time. This minimizes the need to forecast demand, given the actual and real demand for the product.

#### *State of the Lean Supply Chain: Demand Management*

In order to understand the state of the Lean supply chain, different facets of each of the attributes were tested. In the case of the demand management, four different facets were benchmarked: Demand Signal, Demand Collaboration, Sales and Operations Planning, and Inventory Management Practices. These are discussed below.

As noted in Table 4 below, most respondents continue to generate their demand signals from actual usage history or on projected sales based on actual usage. Less than 50 percent of the responses indicated that there was any ongoing dialog with the downstream supply chain to improve demand data accuracy and timeliness. Only 33 percent indicated that product was being "pulled" through the downstream chain by actual usage, and, of those, slightly less than 15 percent indicated any "real-time" exchange of actual usage data with their customers.

### Demand Management

Pulling products and services when requested by the customer.

Partnerships with customers and suppliers are essential for pull systems to be effective.

Table 4 — Managing the Demand Signal

Internally Focused		Supply Chain Focused		
Percent of All Recipients				
14.2%	39%	13.6%	18.5%	14.8%
Product is “pushed” through the channel based on forecasts.	Demand forecasts are created based on actual usage of product (current stock levels, or min/max levels, or order points) and projected sales.	Downstream supply chain partners provide periodic forecasts to make the immediate upstream partner aware of requirements.	Product is “pulled” through the channel based on actual usage data from upstream supply chain partners.	Product is “pulled” through the channel using consumer demand from point-of-sale systems in near real time.

“When Best Buy sells a PC or a hard drive that is going to require a replacement component from me, I’d like to know.”

*Peter Kelly*  
 Executive Vice President  
 Agere Systems  
 Inbound Logistics, October 2004

**Managing the Demand Signal: What It Means**

Managing the demand signal will, by far, provide the greatest opportunity for those firms that want to “compete supply chain to supply chain.” The results of this study suggest that there is significant room for improvement.

Jim Lico, corporate vice president of Danaher, observes “sophistication of the supply chain (i.e., ability to apply Lean principals) can greatly depend on the sophistication of the customer,” pointing out the Procter & Gamble (P&G) and Wal-Mart relationship as an example of a sophisticated supply chain where Wal-Mart sends POS data from each of its stores every two hours to P&G via satellite.

Across the board all interview participants expressed the importance of getting demand data both from customers and to suppliers. While having real-time, point-of- sales, demand data transfer is best practice, interview participants (especially those not in involved in the retail sector) indicated that this is a challenge within most industries. While receiving real-time POS data may not be realistic for their industry, some indicate that they are actively using POS even if there is a delay in getting the information. Others worked with third-party data providers such as Nielson to purchase POS data for their products.

**Demand Collaboration: What It Means**

How well firms manage the demand signal is also reflected in how they view collaboration. Very few responses (5.1 percent) indicated that there was any level of “real-time” collaboration regarding demand. While the numbers were slightly better with respect to electronic communication of sales data (18.5 percent), an overwhelming (76.3) percentage of the group is collecting demand data from their customers only “regularly” or not at all.

Table 5 — State of Demand Collaboration

12.6%	33.9%	29.8%	18.5%	5.1%
Supply chain partners do not work together to share real or anticipated demand.	Key supply chain (2 or 3) partners hold some discussions to get better view of products and markets	Key supply chain partners (2 or 3) maintain regular communication regarding products and sales statistics.	Most supply chain partners (3 or more) exchange product and sales data electronically, typically not in real time.	Demand is conveyed upstream to partners in real time from point of sale. Partners jointly participate in analyzing demand.

Collaboration must begin through management’s understanding and acceptance of the concept, followed by a clear conveyance of this approval and its need to the workforce. Collaboration will continue through the periodic meetings, discussions, and exchange of information between supply chain partners. Supply chain partners including the upstream suppliers and downstream customers can then work together as a team to provide value to the end-user customer.

Our interviews revealed that many firms view collaboration as a tool for use with their supply base and that they are not satisfied with the level of collaboration they have with customers. While companies felt they could exert their “muscle” on their supply base and chose to work only with more progressive suppliers, they felt “locked in” to working with customers who lacked sophistication. In some industries, respondents felt constrained by having to rely on telephone or fax as the primary tool for receiving demand information; across the board however, all companies interviewed have seen an increase in the use of electronic collaboration tools and welcome the technology advances that help share demand data more readily.

The more progressive companies are actively working with their customers to improve demand collaboration efforts—despite their customers’ lack of sophistication. One large (OEM) has proactively learned how to “work around” their customers when possible. While the OEM’s customers were large distributors, they knew that the “end customer” was a limited number of the major oil companies who ultimately used their equipment. As such, the OEM would work with the major oil companies to determine what the real demand projections were.

Another respondent with a complex supply chain that involved multiple tiers of suppliers stated that they have seen problems due to the “offset” of Bill Of Material explosions that were done independently by tier-two and -three suppliers. Their solution? They implemented a process of running simulated manufacturing resource planning for the lower-tier suppliers and providing this information directly to them, which helps them better understand the “real” demand they are projecting.

**Waste and Cost Reduction**

Elimination of waste is one of the key tenets of Lean manufacturing. In the broadest sense, waste can be time, inventory, process redundancy, or even digital waste. Supply chain partners have to work together and individually to eliminate wasteful processes and excess inventory across the chain.

This elimination of waste should have one significant by-product: a reduction in cost for the supply chain. This is not to say that all costs are going to decrease, but rather that the supply chain costs will decrease. It is possible that some costs for suppliers may go up; however these increases should be offset by reductions in other areas. For instance, a supplier may hold inventory (vendor-managed inventory) for a client. The supplier’s costs go up, as they are still responsible for the product, but the customer’s costs should decrease.

Please note that the initial emphasis is placed on reducing waste, and not cost. This is not a matter of semantics, but one of philosophy. A preoccupation with reducing costs may lead a firm down a suboptimal path, as not all waste can easily be tied to costs, yet still have a significant impact on them.

The focus on waste, and not cost, also makes the conversation with suppliers and customers less threatening. If the goal is to reduce waste, most parties are more willing to discuss their processes with one another. An initiative to reduce cost is typically viewed as an approach to raise profitability.

With a joint goal of reducing waste, supply chain partners can work together to modify policies that produce or encourage it. Typically, waste across the supply chain will be made manifest in excess inventory. Reducing inventory can be aided by introducing postponement and customization strategies, which push the final assembly of a completed product to the last practical point in the chain.



**The Seven Wastes of Manufacturing**

1. Overproduction ahead of demand
2. Waiting for the next processing step
3. Unnecessary transport
4. Overprocessing of parts
5. Inventory more than the absolute minimum
6. Unnecessary movement
7. Defective parts

Table 6 — Waste Reduction Efforts

20.7%	30.8%	28.6%	16.1%	3.8%
Waste reduction is focused on the functional areas within the company.	Company analyzes internal processes to minimize waste.	Some supply chain partners are waste-conscious but most focus on cost reduction and profit improvement.	Some supply chain partners begin working together to eliminate waste.	All supply chain partners understand end-to-end processes and work together to eliminate waste throughout the supply chain.

According to our survey, less than 20 percent of the respondents are working with their supply chain partners on waste elimination. While an internal focus on waste will result in cost reductions that can be documented internally, a larger reduction of waste can be achieved by joint efforts. This is clearly an area where there is room for much improvement with regards to implementation of a Lean supply chain.

The antonym of a waste and cost focus is a focus on value-added activities. Respondents who are moved to reduce waste and cost should have a better understanding of what activities actually add value to their customers.

In practice there are many cases where activities are unknowingly duplicated by various supply chain partners. Joe Kennedy, Materials Manger at Teradyne sums up the problem of tracking waste well, pointing out that “while our philosophy dictates that we do not want waste, that is easier to say than do. For Teradyne, tackling waste really starts by actively striving to remove non-value-added activities to help us become more efficient.” Our survey results show that only 25 percent of the respondents’ firms are working with their partners to maximize the value of activities by rationalizing them across the supply chain and eliminating non-value-added activities.

Any waste that is passed on to a supplier or customer always returns in the form of higher costs.

Table 7 — Value-Added Activities

12.5%	28.2%	34.2%	21.5%	3.6%
No clear distinction between value-added and non-value-added activities	Individual supply chain aware of value add, but have not actively worked to eliminate non-value-added activities	Individual supply chain members focused on eliminating non-value-adding operations within their own businesses	Collaborative practices are being explored with supply chain suppliers or customers to eliminate non-value-added activities.	Collaborative practices are actively being performed with both suppliers and customers to eliminate non-value-added activities.

Fifty-three percent of the Lean adopters indicate that they work with supply chain partners to eliminate non-value-added activities. Conversely, nearly 60 percent of the early Lean group either do not understand the concept of value add, or are not actively working with their partners to eliminate non-value-added activities.

During our interviews we found that value stream mapping has become a keystone of the leaders in Lean adoption. Many conduct workshops or cooperative business planning sessions with their suppliers and customers to ensure enhancement of their individual value add.



**Process Standardization**

The third attribute of a Lean supply chain is process standardization. Process standardization enables continuous flow to occur in the company, a major tenet of Lean manufacturing.

Flow is the uninterrupted movement of a product or service through the system to the customer. Major inhibitors of flow are work in queue, batch processing, and transportation. These roadblocks slow the time from product or service initiation to delivery.<sup>3</sup>

The “flow” or “value-stream” perspective represents a shift from vertical to horizontal thinking. Horizontal thinking means looking across the traditional vertical structures of functions and departments to connect activities in the stream of the value flowing from suppliers, through the organization, and on to customers. In other words, concentrating on overall flow means focusing on system efficiency rather than just on the point efficiency of individual elements in an organization.<sup>4</sup>Flow is enabled when materials and processes are standardized across the supply chain to reduce complexity.

These efficiencies can only be gained through collaboration across the supply chain and by developing standardized processes for use in providing products and services that add value and eliminate wasted or duplicated steps.

A thorough understanding of the processes involved through the supply chain will help partners to work towards standardizing important processes and shifting work to the most efficient point in the chain. One of the important processes that transcend firms is planning and production; findings can be found in Table 8 below.

“We really focus on using metrics to drive standardization.”

*A Lean manager  
Aerospace technology*

Table 8 — Planning & Production Process Standardization

6.8%	32.7%	41.3%	12.8%	6.4%
No attempts are made to standardize processes internally or externally	Processes may be documented by the operator but may be considered “proprietary” and are not shared with supply chain partners.	Processes are documented and general process understanding exists across the supply chain.	Processes used by the various supply chain partners are well understood by all, though not standardized.	Planning, production, and stock management processes are defined and standardized across the supply chain.

<sup>3</sup> “How to Compare Six Sigma, Lean and Theory of Constraints,” by Dave Nave, Quality Progress, March 2002

<sup>4</sup> “What Are We Learning Since We Started Learning to See,” by Mike Rother, www.lean.org

**Lean adopters** are more likely (43%) to collaborate with supply chain partners on process standards. Non-adopters are significantly less likely (51%).

**Lean adopters** are more likely to enforce company product standards (63%). Nonadopters indicated weak enforcement of company standards or no standards at all (50%).



While there appears to be a high level of documentation of planning and production processes, and good general process understanding across the supply chain, fewer than 20 percent of respondents indicated that the processes were “well understood.” Further, only 6.4 percent indicated that these processes have been standardized across supply chain partners. More than 30 percent indicated that they felt their processes were “proprietary” and therefore not shared with their supply chain partners.

In addition to process standardization, benefits can be derived from standardizing products used in the manufacturing or assembly of goods—in other words, sharing subcomponents across product lines. This way, fewer unique components are needed, reducing manufacturing, warehousing, and development costs. As Table 9 below indicates, more than 88 percent responded that they were making some efforts to standardize products internally, with nearly 40 percent actively involved in processes used to establish and use internal product standardization.

Table 9 — Company Product Standards

11.8%	29.5%	19.4%	27.7%	11.6%
Products are nonstandard. No shared components.	Internal parties attempt to impose standardization of product components.	Internal parties agree to standardize product components.	Parties actively look for opportunities to share components during new product development	Products developed have a high proportion of shared parts from other product lines.

These efforts are worthwhile for many reasons. Standardization helps reduce the number of different components and suppliers, and standardization of components and subassemblies can help promote postponement efforts to reduce inventory levels of finished goods.

During our interviews we found that even the large conglomerates, which have varied and multifaceted businesses, have benefited from sharing of processes and product standards. Now different sites can share intellectual property, metrics, and best practices for many activities, and use metrics to drive standardization.

**Industry Standards Adoption**

Product and process standardization between trading partners can still lead to waste, especially where common components are not common practice. For instance, plugging a telephone into a wall outlet is the same in all fifty states; in this case an industry standard was developed and accepted. When that does not happen, as in Europe, multiple standards—and products to meet these standards—have to be developed and maintained.

Industry standards should be utilized wherever possible, and supply chain members should participate in industry standards bodies. Standardization of products is a benefit to customers who are using the products, and enhances serviceability. However it also decreases the proprietary nature of the product, making other competitive factors such as an efficient supply chain more important.

Table 10 — Industry Product Standards

16.5%	13.9%	42.9%	14.1%	12.7%
No industry standards, and products are considered to be "proprietary."	Individual partners attempt to set their own standards outside of industry standards groups.	Partners make partial use of industry standards in development of new products.	Partners agree to standardize products based on standards set by outside groups.	Supply chain partners participate in industry standards bodies. Partners use industry standards in development and manufacture of products.

Survey results indicate that roughly 70 percent of the respondents indicated they make use of industry standards when developing new products. More than 26 percent indicated that their supply chain partners agreed on standards to be used in products.

Lean adopters participate in standards bodies and work with partners on standards (48 percent). Non-adopters indicate that while they may make partial use of industry standards, 34 percent use no industry standards or may attempt to enforce their own on the group.

Standardization is not limited to products, but it can also dictate how information is shared across the supply chain. As companies increase their supply chain systems capabilities they increase the amount of data to organize, understand, and leverage. Add in RFID capabilities, POS data, and collaboration with trading partners, and the data increases exponentially. As data increases, so too does the risk of digital waste. Digital waste is defined as information that is not related to or supporting of defined goals and metrics. If data cannot be tied to specific objectives and therefore be germane to decision-making processes, it is worthless to the organization. Worse, digital waste can cloud and congest decision making unnecessarily.

Digital waste can be minimized by agreeing to data standards that will enable the free flow of information. As noted in Table 10 below, one extreme is to consider data to be proprietary and not shared. A Lean supply needs more information to be exchanged and available in a standardized format.

### Digital Waste

Digital waste is defined information that is not related to or supporting of defined goals and metrics. If data cannot be tied to specific objectives and therefore be germane to decision making processes, it is worthless to the organization. Worse, digital waste can cloud and congest decision making unnecessarily.

Table 11 — Data Standards

20.9%	41.9%	19.3%	15.3%	2.6%
Data is considered to be proprietary and is not shared.	Individual supply chain partners make information available to key partners but make no attempt to assist in data conversions.	Key supply chain partners (2 or 3) jointly develop data mapping to convert each other's proprietary formats.	Key supply chain partners (2 or 3) use standardized data formats for information exchange.	All supply chain partners exchange product, availability, and sales-related data using global and/or industry-standard data formats.

**Lean adopters** see exchange of data as a tactical advantage and are more likely (40%) to work with partners on data standards to ease integration issues.

Results show that less than 20 percent (17.9 percent) are using standardized formats for exchange of information between supply chain partners. Another 20 percent consider their data to be proprietary and make no attempt to share it with their partners, while nearly 42 percent of those surveyed simply make the data available with no attempt to assist their partners in making use of it.

Nonadopters indicate that they either consider data to be proprietary, or they make it available to key partners with no conversion assistance (77 percent).

**Cultural Change Agent**

Supply chain partners including the upstream suppliers and downstream customers work together as a team to provide value to the end-user customer.

Collaboration must begin through a management understanding and acceptance of the concept, followed by a clear conveyance of this approval and its need to the workforce. It will continue through the use of period meetings, discussions, and exchange of information between supply chain partners.

There is one problem with applying Lean concepts—they have to be applied by people. These are the same people who are doing things the old way today, the same people who have been doing things the old way for a long time, the same people who have a vested interest in doing things the way they have always done. This is one of the biggest challenges in getting Lean.

So how do our respondents view people in their organization? Are they expendable? Or, are they seen as a valuable asset that enables formal improvement processes to be put in place?



Table 12 — People

9.4%	21.9%	27.3%	26.3%	15.1%
Employees are viewed as being expendable. Most training is limited to on-the-job training.	Managers concerned about employees, but little institutional support or resources	Managers actively work to manage employee turnover. Some support for employee development.	Resources made available for employee development. Continuous improvement culture in most departments.	Employees believe that they are a valued asset. Formal improvement processes in place.

**Lean adopters** see employees as a valued asset and emphasize employee development (77%). Nonadopters are more likely to see employees as expendable and provide little support for development programs (47%).

Nearly 70 percent of the responses show that there is an active process in place to enhance employee development and reduce turnover. While our survey did not question the application of supply chain processes to employee development programs, this training should be a part of the process.

People can enable change, or stand as a road block to it.

Table 13 — Continuous Improvement / Change Culture

3.4%	20.4%	32.1%	27%	17.1%
No continuous improvement programs in place	Informal improvement projects in place	The need for change/improvement has been identified and communicated to the workforce by top management.	Operational-level “change leaders” have been identified and are being educated on the need to change and how to effect change.	Management has a well-developed, published vision for all facilities and has operating objectives that fully support the vision. A continuous improvement culture exists across the supply chain.

More than 75 percent of the responses indicated that there is some form of continuous improvement or culture-changing process in place within the firm. However only 17 percent indicated any efforts were made to publish a vision for CI, or to extend this strategy across the supply chain.



**Five Steps to Implement Lean**

1. *Specify Value.* Identify which features create value. Define value from the final customer.
2. *Map.* Identify the sequence of activities called the value stream.
3. *Flow.* Make the activities flow continuously through the remaining value-created steps. Eliminate barriers and develop product-focused organizations that dramatically improves lead time.
4. *Pull.* Letting the customer pull product or service through the process eliminated the need for a sales forecast.
5. *Perfect the process.* Manage the perfection so that the number of steps and the amount of time and information needed to serve the customer continually falls.

More than 80 percent of the Lean adopters responded that they have continuous improvement programs. Of the nonadopters, 43 percent indicated that they have no program or no formal program. Suggestions on how to implement changes are noted in the text box to the left.

During our interview process we found that leaders in Lean adoption were emphasizing Lean and TQM training during the new employee indoctrination. Over time this thinking becomes ingrained in the way they do business. One manager indicated that “unlike some businesses that think it is an enabler, we think of it as a strategy.”

**Cross-Enterprise Collaboration**

Leveraging the Lean principles of defining value and understanding the value stream, supply chain partners work to maximize the added value provided to the customer.

This is accomplished in part by fulfilling the principles described here, but the objective must be to understand value as it applies to the customer. Added services, regardless of the perceived value of the supply chain partners, are only of true value if they are understood and desired by the customer.

One of the enablers of cross-enterprise collaboration is the use of teams. In a Lean supply chain, these teams are not functionally oriented, or focused on their organization. Rather, they have a broader perspective, and consider what is right for the supply chain.

The survey indicates that while nearly 90 percent of the responding firms have implemented some form of cross-functional teams, less than 25 percent of respondents use cross-supply-chain teams. Supply chain partners should focus on development of cross-partner teams to improve their working relationship and provide a foundation for any Lean supply chain activities.

Table 14 — View of Teams

10.3%	46%	19.2%	20.8%	3.8%
Little or no use of process improvement teams. Teams work within a functional department only.	Some use of cross functional teams within a company.	Team members at individual supply chain member companies actively work together for internal processes only. “What’s In It For Me” (WIIFM) has been addressed at all levels and is understood and accepted.	Cross-company supply chain teams exist to develop an understanding of how process-improvement practices can be implemented across supply chain partners.	Cross-company supply chain teams proactively recognize opportunities and enact positive change for the benefit of the entire supply chain, even if it means less revenue on behalf of their individual company.

## Point of View

For every action there is an equal and opposite reaction. This axiom is most felt when firms start on the road of change.

There are three significant findings we would like to suggest based on our research. These are:

- The obstacles to implementing a Lean supply chain are present, but not insurmountable.
- Lean has the ability to be a cultural change agent
- Real gains in the Lean supply chain will only result from a focused attention on communicating the demand signal across all organizations.

### Obstacles are real—but not insurmountable

Respondents were asked to identify obstacles to implementing Lean initiatives in their organizations. Respondents could check all that applied to their situations; the percentages below represent the percent based on the total number of responses.

Table 15 — Obstacle to Implementing Lean

Initiatives	Percent
Lack of resources	27.2%
Lack of training	25.7%
Lack of top management commitment	21.2%
Involvement in other activities (Six Sigma, TQM)	11%
Hard to apply in my industry	8.5%
No clear benefit of Lean	6.3%

Note: multiple responses were allowed; percentage based on total of all responses.

Lack of resources and training were the most frequently cited obstacles to implementing Lean practices, with top management commitment following closely behind. Few respondents indicated that they did not see a benefit or that the principals did not apply to them. This may indicate that there is no clear way to perform a cost-benefit analysis for justification of the project. If top management executives were shown a positive short-term return on investment, they would likely provide training and resources to support the effort.

What is interesting is that top management commitment was not the most significant obstacle.

For those respondents who have started a Lean implementation project, most indicated that the process started with top management. This turnaround from the responses to the previous question would seem to show that sufficient justification had been given in these cases. While the second-most-dominant starting point was plant management, it is interesting to note that logistics/supply chain group was the second-most-cited as “first” to start the process. This appears to indicate an awareness of the benefits by supply chain professionals within those firms who have started the journey.

**Using Lean as a Cultural Change Agent**

One of the key benefits of Lean is that it has the ability to provide a framework for change. It, much like Six Sigma, provides a methodology and the needed terminology that allows for common definitions of key terms.

Cultural change has to start internally and then include significant and relevant partners. In both cases the emphasis on processes within and between parties highlights opportunities for change.

For cultural change to be effective it must start at the top. Resistance to change exists in almost any situation. Understanding that Lean is a business strategy that is highly visible to management can help to motivate management and staff to ensure its success. It will be helpful too if each affected employee, within each supply chain partner firm, understands the benefit that will accrue to them through the effective implementation of Lean.

It should be pointed out, however, that there is a significant difference between cultural change and attempting to achieve bottom-line improvements. As we have seen too often, firms focus far too often on costs, and not enough on outcomes. That is, the starting point will be significant bottom-line improvement. While this is laudable, it tends to force employees and managers to look for short-term fixes to long-term problems.

Lean provides a set of tools and an operating philosophy that provides a structure for thinking beyond the short term. The emphasis on waste and cost reduction is holistic, and should not be limited to a single partner in the supply chain. Changing the culture to enable greater sharing of data—and trust—is critical.

## In Summary

Our survey and the follow-up interviews revealed and/or confirmed the following:

- Lean is seen as a cultural change agent.
- There is willingness on the part of participants to adopt industry standards.
- Process standardization is early in its journey.
- Real gains will only be made if:
  - Demand signal is managed across the supply chain.
  - There is more emphasis on cross-company collaboration.

We also found that in order to be successful, the following actions must be taken:

- We must promote a better understanding of the value of Lean within the supply chain.
- Lean education and training must be expanded outside of the traditional manufacturing area.
- Management and practitioners must step up efforts to improve collaboration and partnering throughout the supply chain.
- There must be a set of metrics and benchmarks for validating the benefits.
- Involved firms must monitor and report on performance.

### Work to manage the demand signal

If you can focus on only one attribute—and only one improvement—in your supply chain, this would be it. Better managing the demand signal across your organization, as well as communicating it to your suppliers, will lead to better supply chain performance.

Perhaps an analogy will be helpful. Suppose for a moment that an inactive, unathletic person decides to become a marathon runner. Clearly their body would undergo some dramatic changes: loss of weight, better muscle tone, more energy, lower resting heart rate, just to name a few. All of these lead to a more healthy body. Yet, the goal was not to be healthy, but to be a marathon runner.

In the same way, our goals impact the rest of the body. When firms work to understand how they manage their demand signal, many of the other attributes that they have been working on take on new meaning. Accomplishing the goal of managing the demand signal requires that support of other key attributes within the company.

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Far too often, companies focus on costs, and not on outcomes.

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To **understand** your demand signal, map how the signal is transmitted from your customer, through your firm, and to your suppliers.

How do you focus on the demand signal? One specific tool that is relevant and helpful is process maps, or value maps. It is the first step at showing how the signal is communicated across the supply chain. Next, look for improvements in the process. Perhaps answering a few questions like those below will point you in the right direction.

- How can the signal's velocity be increased?
- What are the benefits of increased velocity?
- Who benefits from increased velocity or visibility of the signal?
- Who sees the signal now, but doesn't use it?
- Who doesn't see the signal, but could benefit from it?
- What are the roadblocks that hinder the signal?
- What support or training is needed?
- What metrics need to be put in place to measure and encourage changes?
- What compensation/bonus plans are in place that may run counter to this initiative?

Managing the Lean supply chain is not easy. It, much like Lean manufacturing, is not a destination that one can reach, but is rather a journey to embark upon. It is a journey of awareness, introspection, and improvement.

The big question is always asked before the journey begins: Will it be worth it? Our data—both qualitative and quantitative—indicates that firms can achieve significant improvements by working on these attributes. This journey is based on facts, and not just faith. Working with others, we wish you the best on your journey towards a Lean supply chain.

## The Authors

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Mr. Abbott has more than 15 years of experience in supply chain management, from industry operations, management consulting, and software/technology sales. For the past four years, Mr. Abbott has lead the national supply chain management sales team for Oracle Corporation. This team of functional experts serves as primary sales force for Oracle's supply chain suite of applications. This includes—sourcing, procurement, planning, manufacturing, maintenance, and logistics. Prior to joining Oracle Corporation, Mr. Abbott spent six years with Accenture in the Supply Chain Strategy Practice.

Mr. Abbott also has five years of operations experience with Saturn Corporation, International Paper, and Georgia-Pacific Corporation, primarily in planning, distribution, and logistics roles. Mr. Abbott holds a BS in logistics and transportation from the University of Tennessee and an MBA from Georgia State University. Mr. Abbott is a member of APICS and the Council of Logistics Management.

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Dr. Manrodt is an Associate Professor in the Department of Management, Marketing & Logistics at Georgia Southern University. An active member of the Council of Logistics Management (CLM), he is serving as the 2004 Annual Conference Chair. Research interests revolve around the role of information in logistics systems, performance measurement, the role of logistics in health care, and customer value determination in a logistics setting. His publications have appeared in such journals as the Journal of Business Logistics, DC Velocity, Supply Chain Management Review, Transportation Journal, the International Journal of Physical Distribution and Materials Management, and Interfaces. His research on top shippers has appeared in Logistics Management for the last thirteen years. Dr. Manrodt has recently coauthored a second book, *Keeping Score: Measuring the Business Value of Logistics in the Supply Chain*, for the CLM.

### Kate Vitasek

Ms. Vitasek is a thought leader in the area of supply chain management and is a well-recognized authority on performance management and metrics implementation.

Her approach to performance management has been widely published; she has authored articles in the Journal of Business Logistics, Supply Chain Management Review, Inside Supply Management, Distribution Business Management Journal, The Manufacturer, CLM's Logistics Comment, and APICS Performance Advantage. Ms. Vitasek currently authors a monthly column, "Measuring Up!" in DC Velocity Magazine, which is read by more than 50,000 practitioners monthly.

Ms. Vitasek currently serves on the Council of Logistics Management Executive Committee and teaches seminars for the Warehouse Education Research Council. Ms. Vitasek has also served on the Supply Chain Council's Deliver Committee. In addition, she is an adjunct faculty member for Wright State University—creating and teaching a course on Lean supply chain management that will start in 2005.

Ms. Vitasek has worked for P&G, Kroger, Accenture's Logistics Strategy Practice, Microsoft, and Modus Media International, a global third-party logistics provider. As a practitioner, Ms. Vitasek has served in marketing, operations, and general management roles— including Director of Marketing, Director of Supply Chain, Vice President of Operations Services, and Vice President and General Manager for Global Accounts.

## About APICS, Georgia Southern University, Oracle, and Supply Chain Visions

### APICS

The Association for Operations Management is the global leader and premier source of the body of knowledge in operations management, including production, inventory, supply chain, materials management, purchasing, and logistics. The association provides comprehensive education and training programs that significantly improve an individual's understanding of operations management practices, strategies, and concepts.

APICS administers the internationally recognized certification programs, APICS Certified in Production and Inventory Management (CPIM) and APICS Certified in Integrated Resource Management (CIRM). Through participation in these and other APICS educational programs, operations professionals gain new skills and update their knowledge with hands-on, interactive training through APICS national workshops, online classes, APICS Webinars, and local chapter certification review courses and workshops and through time-tested study materials, including the APICS Dictionary, the global standard for terms and definitions used in the field.

Learn more about the APICS community by visiting [www.apics.org](http://www.apics.org) or call (800) 444-2742 or (703) 354-8851.

### Georgia Southern University

Georgia Southern University is a growing nationally recognized logistics program located in Statesboro, Georgia. The university is a major teaching and research institution. Members of the faculty publish in a wide range of topics and are invited to speak at events around the world. The Southern Center for Intermodal Transportation offers a wide range of research services and resides in the College of Business.

For further information, please visit [www.GeorgiaSouthern.edu](http://www.GeorgiaSouthern.edu).

### Oracle Corporation

Oracle is the world's largest enterprise software company. We provide innovative software that helps our customers manage and grow their businesses and operations. Our products include an integrated suite of business applications software and other business software infrastructure, including application server, collaborative software, and development tools. We also offer extensive services such as technology and applications hosting, consulting, support, and education.

Oracle's Supply Chain Management (SCM) Suite is among the most comprehensive offered. Our SCM Suite includes sourcing, procurement, manufacturing, advanced planning, warehouse management, mobile supply chain applications, transportation, product lifecycle management, and enterprise asset management to name a few.

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### Supply Chain Visions

Supply Chain Visions is a specialized consulting firm dedicated to helping companies with supply chain strategy and education. Our approach and advice reflects solutions that are strategic as well as practical, cost-effective and focused on driving performance measurement improvements. Founded by Kate Vitasek, Supply Chain Visions has grown into a well-respected organization, bringing thought leadership and visionary supply chain solutions to companies ranging in size from \$4 million to \$20 billion.

For more information on how to address the challenges and opportunities discussed in this report or to obtain additional copies of this publication, please contact:

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