PRTM

A Holistic Approach to Supply Chain Transformations

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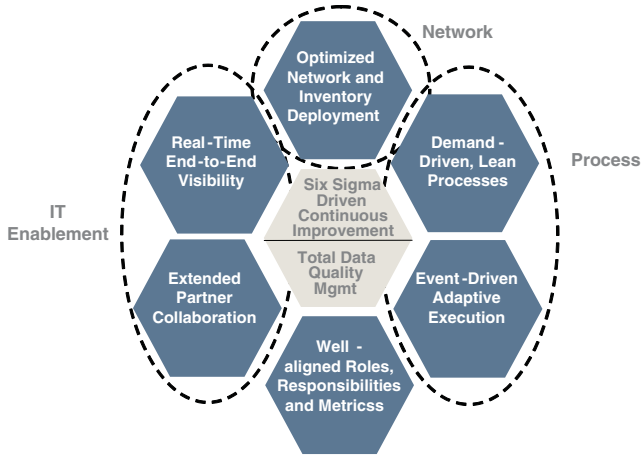
In order to compete successfully in the global economy, companies across industries are hard at work trying to bring their increasingly complex supply chains to the next level of performance in order to meet the growing expectations of customers. PRTM's research shows that companies that operate state-of-the-art supply chains capture enormous value over their competitors. For example, our 2005 benchmarking study demonstrated that profitability—as measured by EBIT (earnings before interest and taxes)—was 14% for the most mature supply chains versus 6% for immature peers. Internal and external integration enables both better demand planning and meeting of customer needs through improved sourcing of materials and asset scheduling. Inventory costs are also reduced, creating the enviable situation of better performance at lower costs. At the highest level of supply chain maturity, the supply chain network is designed to take into account the future product lines, capacity requirements, and capital plans. This longer-term view of the business allows them to make strategic investments that ultimately drive lower costs and improve supply chain effectiveness.

But how do companies accomplish such a high level of performance? Based on the joint work of PRTM and LogicTools, Inc., the integration of a few disciplines in supply chain management—optimization of network and inventory, process excellence, and IT-enabled visibility and collaboration has proved to generate breakthrough operational improvements at reduced overall costs (Figure 1). In this paper, we will first describe this approach on a high level and then illustrate its application with a recent pilot project example at a major industrial manufacturer. The company has successfully incorporated the key provisions of this

Figure 1: Next-Generation Supply Chain: Optimizing Network, Process, and Technology



approach into its ongoing end-to-end supply chain optimization program.

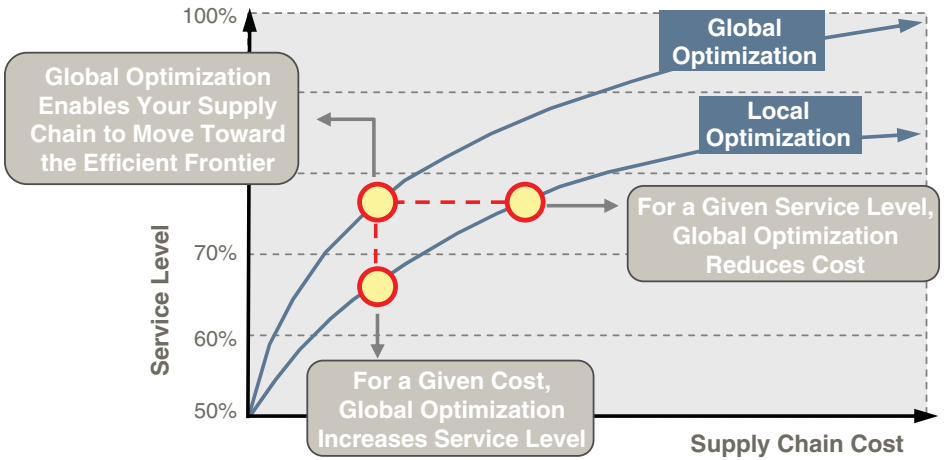
Optimization of Network and Inventory

Research and experience show that the best performing supply chains consistently optimized their network design and inventory management. But despite the fact that a large portion of supply chain costs and capabilities is determined in the design phase, few companies frequently examine the role of network and inventory optimization in their overall supply chain strategy. In a recent study, AMR Research asked more than 300 North American manufacturers how often they reevaluate their network design. Full half of the respondents reported conducting this analysis "seldom" or "every other year." Only 10% of companies analyzed their networks quarterly, followed by 9% every six months, and 31% annually.

Frequent supply chain optimization analysis allows companies to consistently meet their service-level targets at minimum system-wide costs by setting the correct inventory levels at properly configured facilities at the right locations. Its success depends on two types of decisions. Network design decisions include the number of facilities, their sizes, locations, and service territories, as well as product flows through each facility. Inventory decisions determine inventory placement, mix, and safety stocks at different locations. Grounded in in-depth analysis of the key inventory drivers, optimization strategy needs to be robust against a variety of scenarios to allow for uncertainties inherent in demand, supply, and processing/transportation time.

Moreover, many supply chain problems today are caused by the tendency of managers to optimize decisions in the supply chain based on local approaches that look at one facility and one product at a time, or use rules of thumb. A global, end-to-end optimization approach, which addresses supply chain issues holistically, is best suited for making rational trade-offs. As a result, global optimization is more effective and efficient compared to a piecemeal "local" approach (Figure 2).

Figure 2: Benefits of Global Optimization: Better Service, Lower Costs



Process Excellence

Understanding where to start, and knowing how to proceed, are vital elements in improving supply chain processes. The SCOR® model can be a great help. It provides a standardized framework for analyzing the supply chain and identifying the processes that need improvement. The team charged with improving a given process can quickly drill down to a deeper level to identify specific process steps that should be corrected. The model also provides suggested best practices for improving each of the sub-processes.

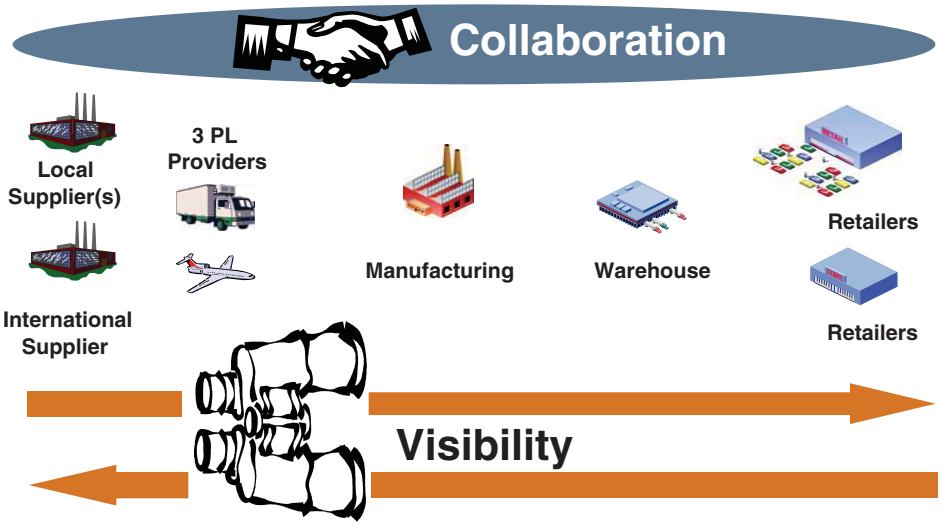
Well-defined metrics and measures are a cornerstone for all top-performing supply chains. In most companies, the biggest hurdle is reaching a consensus on selecting and defining the right metrics. The problem is often not the lack, but rather an over-

abundance of metrics—causing different departments and functions to sub-optimize their local activities at the detriment of the larger goal. SCOR helps to develop a balanced supply chain scorecard consisting of a handful of key "level-one" metrics that should be the focus of supply chain performance. These top-level metrics are supplemented by other lower-level metrics, depending on the granularity of the process the company wants to measure. The definitions for each of these metrics go a long way in helping standardize the measurement across many segments, divisions, and business units.

A key part in improving the efficiency of internal processes is to adopt "lean" manufacturing principles that help reduce inventories and costs while improving customer service. This approach synchronizes customer-driven processes with customer demand using a "pull" approach. Manufacturing should be done only when a downstream process needs materials or parts. This goes a long way in reducing inventories and ensures the operations are always in sync with customer demand. To move in this direction, companies need to focus on both eliminating waste in their processes and striving to become more flexible by having short changeover times and short lead times.

Finally, large companies will perform significantly better if they effectively share their best practices internally across the organization. If every segment in the company starts performing at a similar level to the best-performing supply chain, the benefits could be substantial. Leading companies regularly capture the details of best practices in a standardized format and make them available on an internal website. As more and more improvements are made, they are disseminated across the company. Senior management must encourage this knowledge sharing, and program success should be tracked on a regular basis.

Figure 3: Benefits of Visibility and Collaboration: Seamless Integration



IT-Enabled Visibility and Collaboration

Visibility and collaboration make possible agility and alignment across the extended supply chain. Best-practice companies create an integrated real-time supply chain data platform to collect, manage, and monitor data for improving supply chain visibility and execution. This allows companies to improve visibility of demand requirements, inventory levels, and supply capability. For the data platform to be truly effective, it should incorporate data from internal sources (e.g., manufacturing schedules and manufacturing execution status) as well as from external sources—particularly production schedule data from customers.

Once the companies master the initial aspects of integration, the next stage is a "seamless" sharing of information across partners. By linking its internal systems with those of its customers, the company can rapidly detect changes in demand—and link them into supplier systems to "see" purchase orders at the supplier (Figure 3).

Better visibility has many benefits. It improves inventory accuracy and reduces latency and errors by providing automatic

electronic data capture and upload. It allows the customers to view their order status at any time. It also improves the internal management of the company by enabling integrated data tracking, analysis, and reporting. This capability provides a single, integrated view of key accounts across multiple products lines and facilitates real-time performance tracking and trend analysis.

The next step is to develop capabilities to rapidly act on information in the supply chain. These event-management capabilities allow a company to continuously monitor the supply chain and quickly adapt execution to constantly changing situations. They require two things: First, define the business rules that will be guiding the "exception management" alerts and notifications. Second, set up automatic monitoring of transactions and conditions in an event-management model and automatic issuing of alerts. Examples of these situations would be alerts based on visibility of orders and inventory to provide early warning if standard (or quoted) lead times will be missed. Another example would be to provide warnings to the internal and external suppliers if any supply shipments are late or missed.

After a company has mastered the basic (i.e., reactive) event management, the next stage is to move towards a more proactive stance. This is based on analyzing past data of events and using it to predict when a future event might fail. These proactive notifications will allow a company to take action within the execution window to rectify the situation before it becomes a true problem.

In the remainder of this paper we discuss in more detail this comprehensive approach to supply chain transformation, using a real-life example of a major manufacturing company that aspired to take its performance to the next level. Lessons learned from this assignment confirm that to truly change the supply chain, all key areas of operations have to be considered. Moreover, successful implementation requires considerable skills and energy from top management, along with solid program-management and change-management approaches to guide the changes and communicate the benefits across the organization. Finally, supply chain transformation is an ongoing challenge (as the saying goes, "it's the journey, not the destination"), which requires continual reevaluation in order to meet, and exceed, customer expectations.

Case Study: Supply Chain Transformation

A multi-billion dollar diversified manufacturer with many semi-autonomous business units and a mostly global supply chain wanted to take its supply chain performance to a new level because of structural shifts in demand and supply. These shifts were influenced by off-shoring and outsourcing pressures on the supply side, as well as service-level requirements from major customers like Wal-Mart. In addition, the company was faced with increasing complexity of its products, manufacturing processes, and policies.

An Overview. In response to external challenges, the company launched a major supply chain transformation project that included network and inventory optimization, implementation of process excellence, and IT-enabled visibility and collaboration. The project integrated SCOR, Six Sigma, and network optimization approaches toward the ultimate goal of step change in performance. As Figure 4 shows, the project's approach matched the Six Sigma's distinct phases: define, measure, analyze, improve, and control. The define phase included visioning and goal-setting tasks, which required meetings with the senior executives, interviews, and discussions with a variety of stakeholders both within and outside the supply chain functions. The measure phase involved a comprehensive, quantitative and qualitative benchmarking of the supply chain performance. In the analyze phase, the project team evaluated the company's network, processes, and IT-architecture. The improve phase consisted of design and implementation of the pilot program. Finally, the control phase provided for continual monitoring and on-going improvement of the supply chain.

The project team focused first on optimizing network/inventory of the company's consumer goods' supply chain, which produced 46 products—23 of them finished goods. There were four production facilities

Figure 4: Combining SCOR, Six Sigma, and Network Optimization

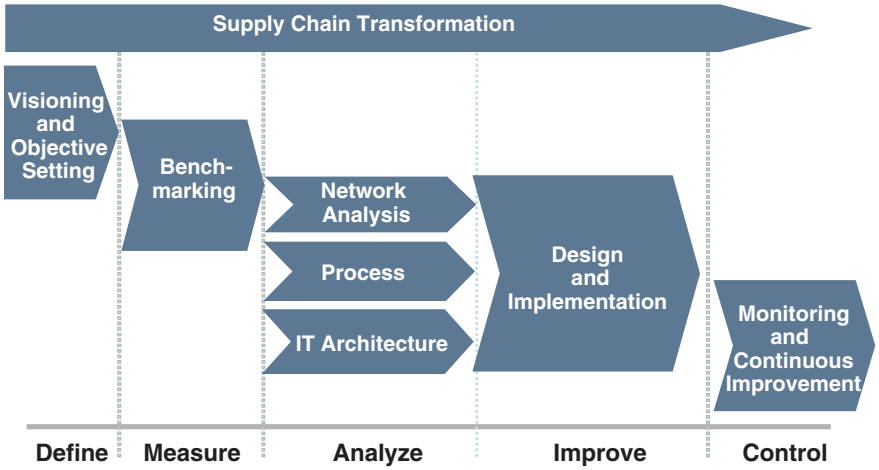
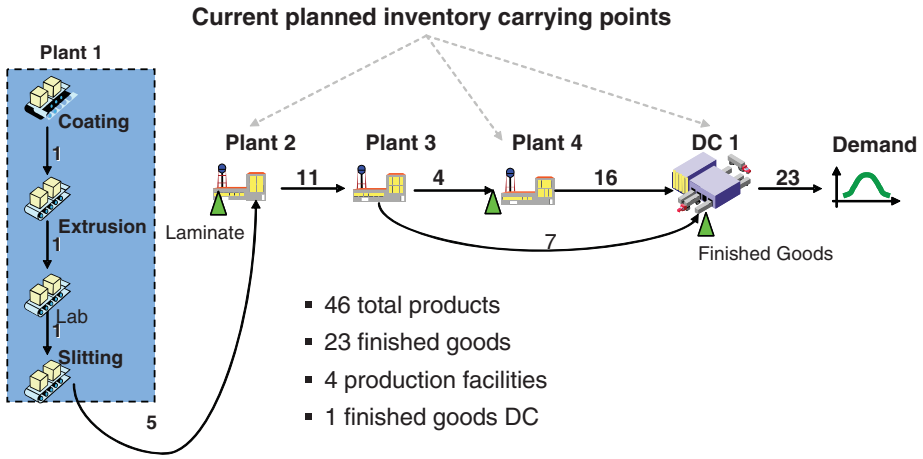


Figure 5: Current Supply Chain Structure



and one finished goods distribution center (DC). The process included coating, extrusion, slitting, and laminating steps. Inventory was stored in the DC as well as in Plants 2, 3, and 4. The team analyzed the supply chain's network structure by mapping the processes, lead times, and demand characteristics. Figure 5 shows the number of products transferred from one process to the next. The demand variation had a normal distribution with rather large forecast errors.

Figure 6 shows the company's existing lead times for the different processes, including transportation times. Long lead times between upstream plants were obviously causing low inventory turns in the network. High inventory and safety stock levels were required at the finished goods DC as a result of the high rate of errors in forecast accuracy, as well as long promised service times upstream (21 to 22 days from Plant 4 to the DC). Order-to-ship times to the customer were shorter, averaging seven days.

Objectives. By using the SCOR mapping process, the project team identified the performance gaps—such as long cycle times (122 days) and low inventory turns (three to four times a year)—which made it difficult for the company to meet the expectations of its major customers. For example, Wal-Mart required 98% service levels while the company was performing on average at only 92%.

Figure 6: Current Lead Times

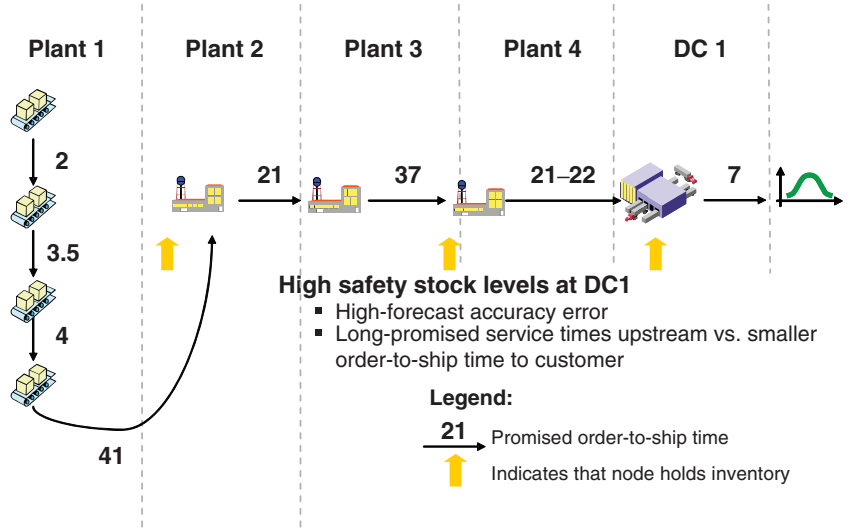
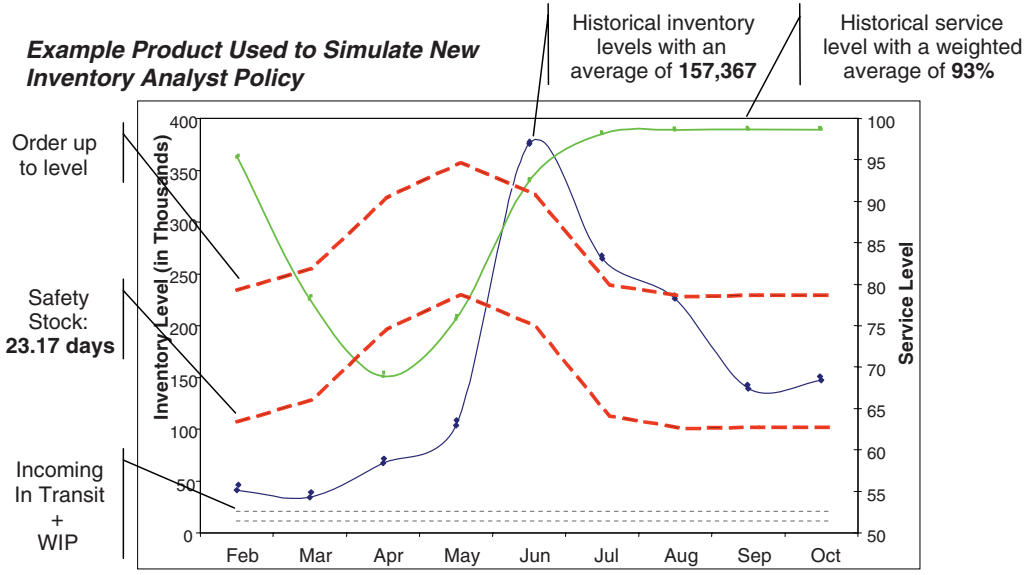


Figure 7: Excess Inventory by Location



The objectives of the study included:

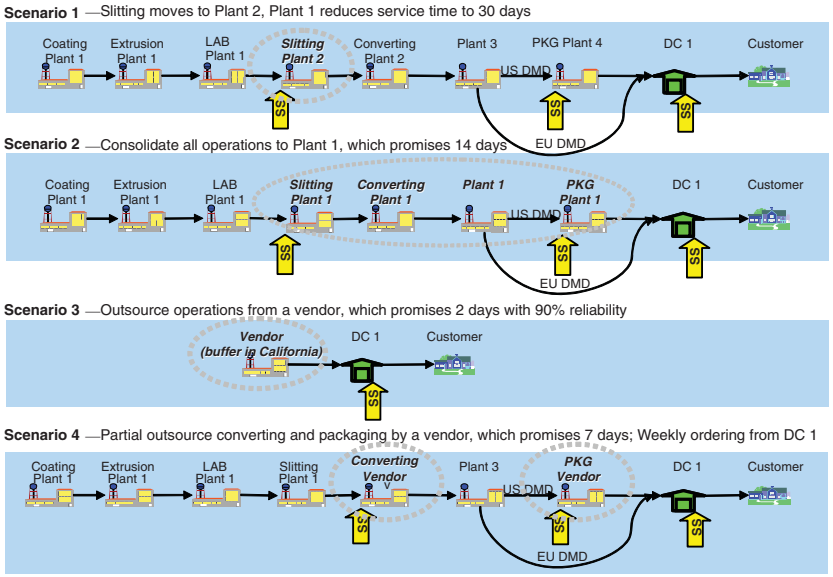
- Reduce excess inventory and improve service levels—replace the existing system that allows single-facility settings of inventory with users manually overriding the outputs.
- Evaluate alternative locations for certain processes—allow for safety stock buffers upstream and/or downstream of current locations.
- Understand key drivers of inventory—determine what is driving the current low turn: order-to-ship time, fill rate, production time, or other factors.
- Asses total outsourced solution—examine the ramifications of different supply chain scenarios on working capital and cost of goods sold (COGS).

Analysis. Even though the company manufactured only 23 finished goods, there were millions of possible combinations of safety stock buffer levels and locations. The root-cause analysis of excess inventory by location—another way of analyzing the performance of the supply chain process—indicated that 73% of total working capital was at the DC. Because of the company's fragmented inventory decision-making process, its planners tended to build buffers at each echelon to protect against the performance of the upstream plants and provide the service level required by customers. The use of multi-echelon inventory

Figure 8: Inventory Position at Current and Target Service Levels

	Current		Required	
Service Level	92%		98%	
	All Products	Finished Goods	All Products	Finished Goods
Working Capital	$874,338	$565,506	$1,027,945	$719,113
Inventory Turns	4.27	6.6	3.23	5.19
Cycle Time	122		122	

Figure 9: Alternative Supply Chain Scenarios



optimization would enable the management to decide on the location of inventory based on total-system considerations. The use of software to visualize the root cause of problems would help to identify best opportunities for making the supply chain more efficient.

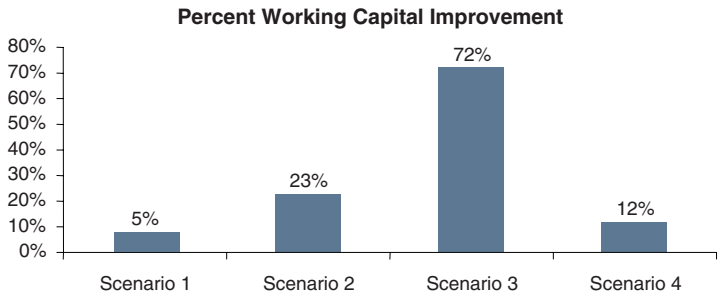
To run sensitivity analysis, the project team first created a baseline model based on current system and costs. Next, the team ran the model with 98% service level, instead of the current 92%, while optimizing across all echelons. As Figure 8 indicates, increasing the service level while maintaining a seven-day order-to-ship time would increase the company's working capital tied in inventory by almost 20%. Validation of the model results against historical inventory and service levels confirmed the model recommendations.

While the company's average service level was historically 92%, its demand variability was quite high, and the inventory ordered to protect against that variability was usually insufficient (Figure 7). A high percentage of the inventory was tied up in finished goods. Without changing the inventory structure and significantly altering its processes, the company would be unable to achieve its target goal of 12 inventory turns and significant reduction of cycle time.

To test alternative approaches to network/inventory optimization, the team considered a number of scenarios and selected four for detailed evaluation (Figure 9).

The results of this evaluation, summa-

Figure 10: Summary of Scenario Results



	Working Capital Improvement	*Inventory Turns All Products*	*Inventory Turns Finished Goods*	*Cycle Time*
Current		3	5	122
Scenario 1	5%	4	6	111
Scenario 2	23%	7	9	14
Scenario 3	72%	8	11	2
Scenario 4	12%	5	7	88

rized in Figure 10, show that Scenario 3 would be the most effective with 72% working capital improvement, followed by Scenario 2 with 23% improvement. This analysis was complemented with a risk analysis that included ability to execute, quality, and competitive positioning. In addition, the project team considered other costs that were not modeled, such as the cost of consolidating the operations in Scenario 2.

The scenario analysis led to the following conclusions:

Scenario 1—Internal plant changes are low-risk and low-reward.
Scenario 2—Consolidation to Plant 1 produces considerable benefits but is expensive to execute and involves added risks.
Scenario 3—Outsourcing is too risky and could hurt competitive positioning.
Scenario 4—Partial outsourcing has low costs and only medium risks, while providing considerable operational improvement.

The company's management decided to reduce the lead time from the warehouse and Plant 4. Other planning changes included lead-time reductions between the other plants and a reassessment of the outsourcing approach. Following an additional analysis, the company selected Scenario 4, which resulted in considerable savings, since the original plan was Scenario 2, which was much too expensive to execute.

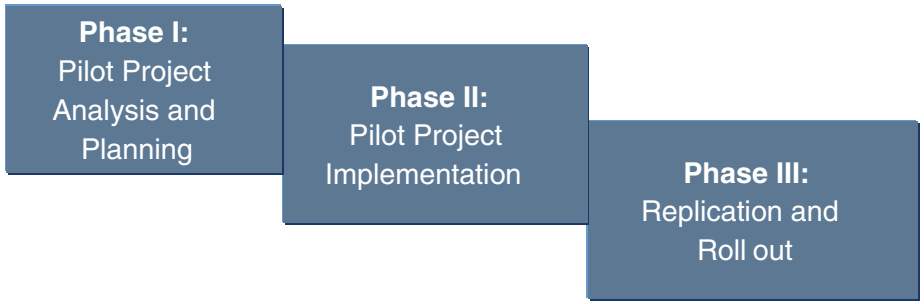
Because of the success of this project, the company decided to create a competency center for supply chain optimization. It has trained a number of experts who are using supply chain optimization technologies to help make decisions in various areas and product lines. Examples include product innovation, network redesign, and inventory positioning.

Implementation. A phased approach to implementation is essential for a supply chain transformation project of this magnitude (Figure 11). Phase I focuses on the analysis and planning, including the selection of a pilot project. It is important to select a pilot project that will truly represent the company's business complexity and challenges. The pilot should also be of a reasonable size and scale to adequately demonstrate the results of the implementation.

The pilot implementation requires significant management attention and change-management skills to guide the project. The senior management team needs to visibly support the project and communicate frequently using a variety of mediums—emails, one-on-one discussions, town-hall meetings, etc. Executive support is essential for the project to gain momentum and dispel any doubts. Moreover, a clear sense of urgency to move forward and obtain short-term wins will help cement the gains made by the project.

The project should be rolled out across the entire company. This is a good opportunity to capture the lessons learned from

Figure 11: Supply Chain Transformation Phases



the pilot implementation and improve the implementation approach by incorporating these lessons. The sequence of replication should be discussed with senior management and the other stakeholders. The replication approach is usually based on a combination of functional, business unit, or geographical rollout across the company. Senior management needs to support the replication consistently; otherwise the process may lose momentum if it is drawn out too long.

About LogicTools, Inc.

LogicTools (www.logic-tools.com), a leading provider of supply chain planning solutions, was founded in 1995 by David Smirch-Levi, professor of engineering systems at MIT. LogicTools provides the expertise, software, services, and support that enable comprehensive supply chain planning processes in a variety of industries. LogicTools' suite of supply chain planning solutions includes network design, inventory planning, and multi-site production sourcing.

About PRTM

Since 1976, PRTM has created a competitive advantage for its clients by changing the way companies operate. PRTM management consultants work with senior executives to develop and implement innovative operational strategies that deliver breakthrough results. The firm is a leader in operational strategy, supply chain, product development, and customer management. PRTM has 16 offices worldwide and serves major industry and government sectors.

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