



Building a World-Class Supply Chain

New Insights from Chemical and Petroleum Producers

Next Generation Manufacturing Study

The MPI Group

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Building a World-Class Supply Chain

Introduction

Chemical and petroleum producers manage complex, asset-heavy supply chains, pulling together feedstocks and materials to service customers around the globe. These firms must swiftly develop and ship immense volumes of product, while adhering to demanding quality standards imposed by customers and tough regulatory requirements that vary by country. Any problem with supply-chain management or production harms customer satisfaction, disrupts business continuity, and poses potential safety and environmental risks. The costs of supply-chain problems and disruptions to the chemical and petroleum industry can be massive.

Suppliers to chemical and petroleum producers must be allies in helping producers achieve customer value, quality, safety and environmental targets. In order to effectively compete today and into the next generation, chemical and petroleum producers must rethink how they manage their supply chains and strive to develop world-class supply-chain management and collaboration.

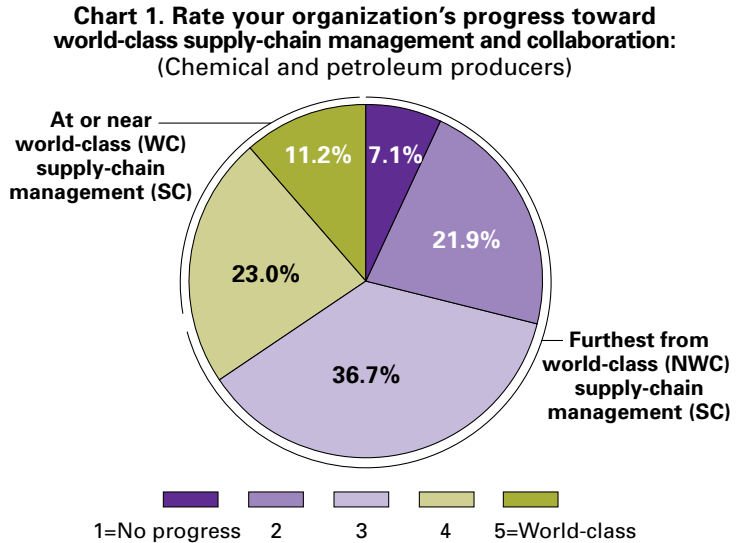
The Next Generation Manufacturing (NGM) Study is one of the largest studies ever on future directions in manufacturing, assessing more than 2,500 manufacturers against six key strategies for success including supply-chain management and collaboration. World-class supply-chain management and collaboration is defined in the NGM Study as “developing and managing supply chains and partnerships that provide flexibility, response time, and delivery performance that exceed the competition.” NGM Study data for chemical and petroleum producers is the basis for this report.¹ To reach a world-class level of supply-chain performance, chemical and petroleum producers must focus on three key objectives:

- Recognize that “supply-chain management and collaboration” is a core strategy, and that achieving world-class performance improves both productivity and customer satisfaction. Surprisingly, many chemical and petroleum firms are not interested in working closer with their supply-chain partners and developing collaborative relationships.
- Support supply-chain management and collaboration with resources, investments, and best practices. Despite good intentions and awareness of the benefits of supply-chain management and collaboration, many firms fail to support this objective with people and tools that enable their companies to execute and improve.
- Rigorously monitor performance to continuously improve visibility into supplier and customer relations and to optimize supplier networks: Many companies react to problems after they arise, lacking systems that support predictability while giving them the ability to monitor and improve their returns from supply-chain management and collaboration.

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World-Class Supply Chains Outperform Competitors

Few chemical and petroleum producers have achieved world-class supply-chain management and collaboration. According to the NGM Study, just 11 percent of chemical and petroleum firms report themselves at a “world-class” level for supply-chain management and collaboration, and only another 23 percent believe themselves near world-class status (Table 1). More than one-quarter of chemical and petroleum producers have made little or “no progress” toward world-class supply-chain status. The tables throughout this report examine how two groups — chemical and petroleum producers at or near world-class supply-chain management and collaboration versus those furthest from world-class status — exhibit vastly different supply-chain practices and performances.



The ability of chemical and petroleum producers to attain superior performance with their supply-chain strategies correlates to the importance they place upon the strategy: Less than half of chemical and petroleum producers (38 percent) indicate that supply-chain management and collaboration is “highly important” to their organization’s success over the next five years (Table 2). But many firms understand the strategy’s importance, but they are still unable to attain world-class status, implying an inability to execute (e.g., lack of best practices, tools or resources).

Especially interesting is the “importance gap” between chemical and petroleum producers at or near world-class supply-chain management versus those furthest from world-class status. Among chemical and petroleum producers at or near world-class supply-chain management and collaboration, 66 percent rate the strategy as highly important, compared to only 23 percent of chemical and petroleum producers furthest from world-class status. A focus on the strategy is critical in achieving world-class supplier management and collaboration.

Table 2. Rate the importance of supply-chain management and collaboration to your organization’s success over the next five years:

	Chemical and petroleum producers	Chemical and petroleum NWC SC	Chemical and petroleum WC SC
1=Not important	1.5%	2.3%	0.0%
2	6.7%	10.2%	0.0%
3	22.6%	31.3%	6.0%
4	31.3%	32.8%	28.4%
5=Highly important	37.9%	23.4%	65.7%

Source: Next Generation Manufacturing Study

Resources and Investments Support World-Class Strategies and Performances

Supply-chain performance management demands visibility into actionable information as well as employees able to make real-time decisions via dashboards, scorecards, analytics, etc. Without information available to dedicated employees, how can the supply chain be improved?

Approximately one-fifth of chemical and petroleum producers (22 percent) have less than 1 percent of their workforces dedicated to supply-chain management (Table 3), and, similarly, 30 percent of chemical and petroleum producers invest less than 1 percent of sales (three-year average) into information technologies (hardware and software) (Table 4). Investments in both human resources and information technologies by chemical and petroleum producers at or near world-class supply-chain management and collaboration offer a contrast: Approximately 46 percent of chemical and petroleum producers at or near world-class status have *more than 5 percent* of their workforces dedicated to supply-chain management (compared to just 23 percent of chemical and petroleum producers furthest from world-class status), and 28 percent of world-class performers have *more than 5 percent* of sales invested in information technology (compared to just 14 percent of chemical and petroleum producers furthest from world-class status). Similarly, 51 percent of chemical and petroleum producers that invest more than 5 percent of sales into IT report their organization at or near world-class supply-chain management and collaboration, versus just 20 percent of petroleum producers that invest less than 1 percent in IT.

Chart 3. What percentage of your workforce is dedicated to supply-chain and partner development, management, and collaboration?

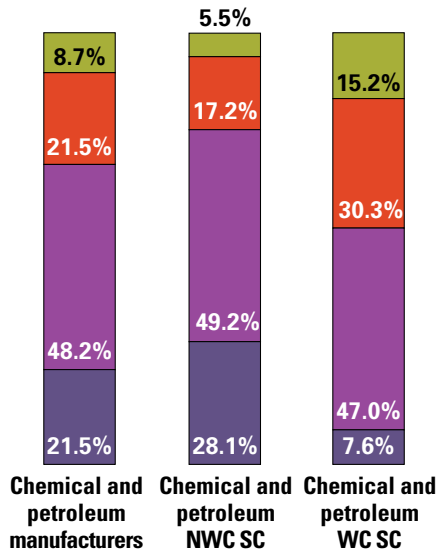
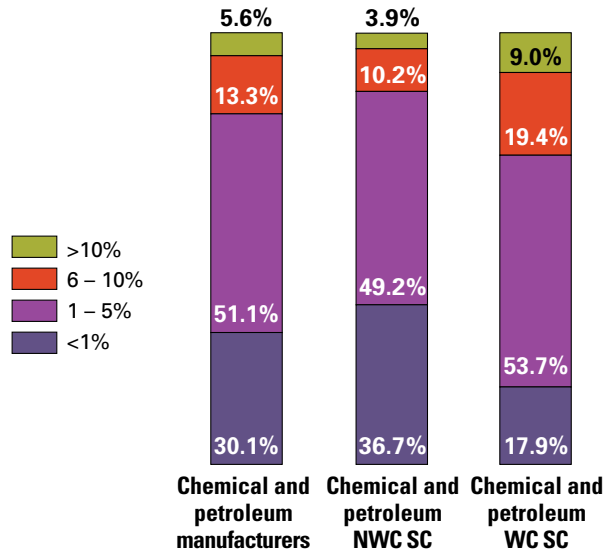


Chart 4. What is your organization's investment in information technologies (hardware and software) as a percentage of sales (three-year average)?



Source: Next Generation Manufacturing Study

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Visibility of information is critical to supply-chain management and collaboration. Chemical and petroleum producers need to understand what’s happening, from furthest raw-material providers to end customers: Are supplier feedstocks in compliance with product specifications and available in the right quantity at the right times? Is production able to accommodate new materials for new formulas? Does customer feedback flow back up the supply chain so that all parties can react and improve? Is supply-chain performance managed in a manner that optimizes ROI?

Many chemical and petroleum producers don’t measure their supply-chain performances very well — if at all.

Many chemical and petroleum producers don’t measure their supply-chain performances very well — if at all. Approximately 24 percent of chemical and petroleum producers have “no measurements system per se or reviews” in place to assess the return on supply-chain

management and collaboration efforts. Another 25 percent have only “ad hoc monitoring of basic measures and ad hoc reviews” — in other words, when they really need to find data, they scramble for it. Only 8 percent of chemical and petroleum producers report having “regular monitoring and review of company-specific metrics by CEO and senior staff and transparency and clarity throughout the organization.”

Chemical and petroleum producers will find it difficult — if not impossible — to be proactive and stay ahead of supply-chain problems and challenges without appropriate measurement systems and tools. Chemical and petroleum producers at or near world-class status understand this, and they are much more likely to have advanced measurement systems in place: 85 percent report having better than ad hoc measurement systems, compared to only 34 percent of chemical and petroleum producers furthest from world-class supply-chain management and collaboration.

Table 5. What best describes your measurement system for reviewing return from supply-chain management and collaboration?

	Chemical and petroleum manufacturers	Chemical and petroleum NWC SC	Chemical and petroleum WC SC
No measurement system per se or reviews	23.6%	32.8%	6.1%
Ad hoc monitoring of basic measures and ad hoc reviews	24.6%	32.8%	9.1%
Company-specific metrics monitored regularly by operations staff	27.7%	21.9%	37.9%
Regular monitoring and review of company-specific metrics by CEO and senior staff	16.4%	9.4%	30.3%
Regular monitoring and review of company-specific metrics by CEO and senior staff and transparency and clarity throughout the organization	7.7%	3.1%	16.7%

Source: Next Generation Manufacturing Study

Application of information technology won’t instantly improve a chemical and petroleum producer’s supply chain. Indeed, without sound practices and processes in place; dedicated staff to manage and execute toward goals; and properly scoped and selected applications, new information technologies may only add complexity and may impair a firms’ ability to identify and solve problems. But with the right strategic focus — supply-chain management and collaboration — these tools can help chemical and petroleum producers close the loop on supply-chain performance management, aligning supplier activities with sales and operations planning processes.

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Performances Drive Future Success

Chemical and petroleum producers at or near world-class supply-chain management manage their organizations and supply chains differently and outperform their industry peers.

The NGM Study reviewed the ability of producers' supply chains to respond to unexpected customer demands for existing products. Approximately one in 10 producers (13 percent) described their supply chains as highly advanced and responsive, with “real-time communication of demand signal and entire supply chain flexible to demand spikes — standard delivery times consistently met and just-in-time inventories” (*Table 6*). But 34 percent of chemical and petroleum producers report that some kind of delay — “major” or “minor” — occurred when communicating demand signals and that extra inventories were needed to meet the demand.

Approximately 22 percent of chemical and petroleum producers at or near world-class status identified their supply chains as highly advanced and responsive extended enterprises, compared to just 8 percent of firms furthest from world-class status. In addition, firms at or near world-class status were far less likely to indicate the presence of major or minor delays compared to producers furthest from world-class status (12 percent versus 46 percent).

Table 6. What best describes your end-to-end supply chain’s ability to respond to unexpected customer demand for existing products?

	Chemical and petroleum manufacturers	Chemical and petroleum NWC SC	Chemical and petroleum WC SC
Major delays communicating demand signal throughout chain and most suppliers struggle to efficiently meet demand — standard delivery times dramatically exceeded and/or excessive inventory	6.6%	9.3%	1.7%
Minor delays in communicating demand signal throughout chain and some suppliers struggle to efficiently meet demand — standard delivery time exceeded and/or too much inventory	27.7%	36.4%	10.3%
Efficient communication of demand signal throughout chain with most suppliers efficiently satisfying demand — standard delivery times nearly met and right-sized inventories	53.0%	46.7%	65.5%
Real-time communication of demand signal and entire supply chain flexible to demand spikes — standard delivery times consistently met and just-in-time inventories	12.7%	7.5%	22.4%

Source: Next Generation Manufacturing Study

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Manufacturers have only just begun to examine the size of inventories throughout entire supply chains, and, similarly, research is now studying the movement of these inventories up and down the supply chain. While many chemical and petroleum executives believe that their firms are managing inventories more effectively within their own plants and companies, it's clear from the new NGM Study data that some of this management was merely shifting inventory onto suppliers or out to customers. More than half of chemical and petroleum producers (52 percent) report that the total value of inventory in their supply chains for their primary products — furthest supplier to end customer — has been reduced by less than 10 percent over the last three years (*Table 7*). Only a handful of chemical and petroleum producers have made substantial improvements: 16 percent have decreased inventories by more than 25 percent over the last three years.

Chemical and petroleum producers at or near world-class status are more likely to have *modest* success influencing inventory across their supply chains: 65 percent have reduced supply-chain inventory by 10 percent or more, compared to 39 percent of chemical and petroleum producers furthest from world-class supply-chain management. But the inability of even world-class performers to make substantial inventory reductions in their supply chains shows how difficult it is to completely remove inventory from large, complex supply chains. Too often delivery and customer satisfaction are maintained only through higher levels of buffer and safety stocks.

Table 7. By approximately what percentage has total value of inventory throughout the supply chain for your primary product (furthest supplier to end customer) been reduced over the last three years?

	Chemical and petroleum manufacturers	Chemical and petroleum NWC SC	Chemical and petroleum WC SC
<10%	52.1%	61.0%	34.8%
10–25%	31.6%	25.2%	43.9%
26–50%	12.6%	9.8%	18.2%
>50%	3.7%	4.1%	3.0%

Source: Next Generation Manufacturing Study

Approximately one-quarter of chemical and petroleum producers describe their supply chains as a competitive advantage in terms of flexibility and speed to market because of strategic partnerships with suppliers and customers: 24 percent of electronics manufacturers report either “strategic suppliers and customers are active participants in our operations, continuous improvement, and product development efforts” or “strategic suppliers and customers are active participants in our operations, continuous improvement, and product development efforts and participate fully in strategic planning and identifying and responding to new markets” (*Table 8*). One-third of chemical and petroleum producers (35 percent) are still stuck in traditional buy-and-sell relationships where suppliers are measured only on cost, quality and delivery performance.

Chemical and petroleum producers at or near world-class status were nearly four times more likely to have assembled supply chains that represent competitive advantages, with approximately 46 percent citing the presence of “strategic suppliers and customers” in those supply chains, compared to just 12 percent of firms furthest from world-class supply-chain management and collaboration.

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Table 8. How is your supply chain a competitive advantage in terms of flexibility and speed to the marketplace?

	Chemical and petroleum manufacturers	Chemical and petroleum NWC SC	Chemical and petroleum WC SC
Suppliers regularly measured on cost, quality, and delivery performance	35.3%	42.6%	20.9%
Suppliers regularly measured on cost, quality, and delivery performance as well as total acquisition cost	10.0%	10.7%	9.0%
Suppliers regularly measured on cost, quality, and delivery performance as well as total acquisition cost and "soft" qualities (e.g., trust, flexibility)	30.5%	34.4%	23.9%
Strategic suppliers and customers are active participants in our operations, continuous improvement, and product development efforts	17.9%	9.8%	32.8%
Strategic suppliers and customers are active participants in our operations, continuous improvement, and product development efforts and participate fully in strategic planning and identifying and responding to new markets	6.3%	2.5%	13.4%

Source: Next Generation Manufacturing Study

Superior supply-chain performance management also helps producers to improve internally, as ideas, best practices, and resources are exchanged between supply-chain partners. For example, 34 percent of chemical and petroleum producers at or near world-class supply-chain management and collaboration report value-added per employee of more than \$175,000, compared to just 19 percent of chemical and petroleum producers furthest from world-class status (*Table 9*). Producers at or near world-class supply-chain status also were more likely to have improved their value-add performance over the past three years: 36 percent of chemical and petroleum producers at or near world-class supply-chain management and collaboration had improved productivity by more than 50 percent over three years, compared to 19 percent of chemical and petroleum producers furthest from world-class status (*Table 10*).

Chart 9. What is your value-added per employee ((sales – cost of materials) ÷ number of employees)?

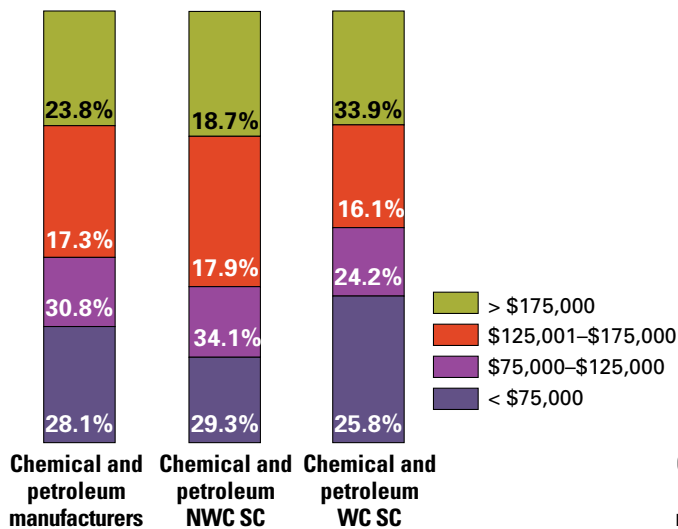
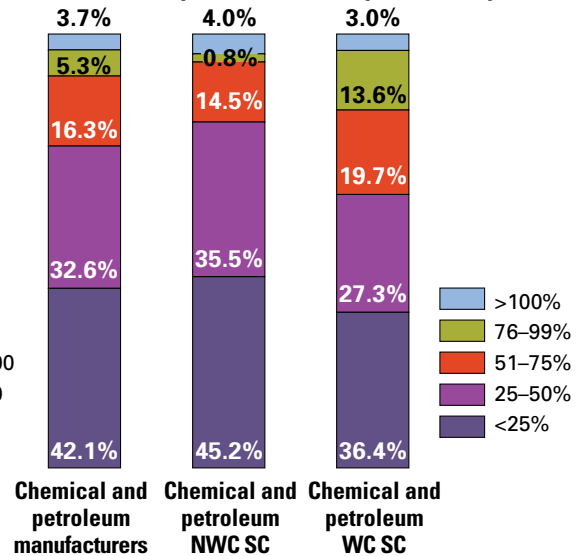


Chart 10. By what percentage has productivity (i.e., value add) improved over the past three years?



Source: Next Generation Manufacturing Study

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Superior supply-chain performance management also helps producers to improve internally, as ideas, best practices, and resources are exchanged between supply-chain partners.

The presence of more advanced measurement systems for monitoring supply-chain returns is critical to improving toward world-class status, with these systems correlating strongly with improved performance:

- 75 percent of chemical and petroleum producers with better than ad hoc measurements systems are able to respond to unexpected customer demand without major or minor communication delays and excessive inventories, versus 54 percent of those firms with no measurement systems or ad hoc systems.
- 57 percent of producers with better than ad hoc measurements systems had reduced inventory across their supply chains by more than 10 percent over the past three years, versus 37 percent of those firms with no measurement systems or ad hoc systems.
- 34 percent of producers with better than ad hoc measurements systems report “strategic suppliers and customers” are a competitive advantage, versus 13 percent of those firms with no measurement systems or ad hoc systems.
- 53 percent of producers with better than ad hoc measurements systems report value-add per employee of more than \$125,000, versus 29 percent of those firms with no measurement systems or ad hoc systems.
- 34 percent of producers with better than ad hoc measurements systems had improved productivity by more than 50 percent over the past three years, versus 16 percent of those firms with no measurement systems or ad hoc systems.

Similarly, higher investments in information technologies (IT) correlated to better performances. For example, 84 percent of chemical and petroleum producers that invest more than 5 percent of sales in IT have reduced supply-chain inventory by more than 10 percent over the past three years versus just 39 percent of those spending 5 percent or less on IT. And 76 percent of producers that invest more than 5 percent of sales in IT had improved productivity by 25 percent or more over the past three years, versus 54 percent of those spending 5 percent or less on IT.

World-Class Supply Management Delivers to the Bottom Line

Chemical and petroleum producers at or near world-class supply-chain management and collaboration are far more likely than their industry peers to focus on supply-chain management and collaboration as a strategy, apply human resources and information technologies to support the strategy, and to be rewarded for those efforts with improved performances than others in their industry. Just as telling are the comments from world-class producers in identifying their organizations' best practices for supply-chain management and collaboration. While many chemical and petroleum producers furthest from world-class status responded "none" or an equivalent ("none in place at this time"), those at or near world-class supply-chain management and collaboration offered myriad ideas that revealed their dedication to the strategy:

- "Collaboration is done with key customers and suppliers to not only align service-level expectations, but also to progress continuous-improvement and value-creation initiatives."
- "Regular review of cost, delivery and performance to standards."
- "Work with customers to understand their forecasts and inventory; vendor-managed inventories; truckload utilization; increase operator awareness through training; optimize utilization through automation and software systems."
- "Using a total-cost-of-ownership model and lean enterprise concepts."
- "Communication with customers and suppliers is our best tool in supply-chain management."

"Collaboration is done with key customers and suppliers to not only align service-level expectations, but also to progress continuous-improvement and value-creation initiatives."

Are these best practices found in your organization? Have you developed trusted working relationships with supply-chain partners? Do you support supply-chain management and collaboration with staff and executives, business system investments, and a modern approach to applying best practices and improving processes? And do you monitor supply-chain performance so that your company

can proactively solve problems and make improvements, getting ahead of challenges before they escalate and migrate throughout the supply chain — and on to customers?

Only by answering "yes" to all these questions will chemical and petroleum producers truly reap the benefits and returns from supply-chain management and collaboration. Which type of organization is your firm?

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About The MPI Group

The MPI Group (MPI) is a Cleveland, Ohio-based research organization specializing in research development, analysis, and communications. MPI services include:

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¹ Data from the Next Generation Manufacturing (NGM) Study, which was coordinated by the American Small Producers Coalition (an association of Manufacturing Extension Partnership centers and partners); conducted by the Manufacturing Performance Institute (MPI); and supported by Manufacturing Extension Partnership centers and partnering organizations. A total of 2,529 producers participated; 197 manufacturers were identified as "chemical and petroleum producers" using NAICS codes that encompassed categories of both "Chemical manufacturing" and "Petroleum and coal products manufacturing." For more information on the NGM Study, go to www.mpi-group.net.