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THE BOSTON CONSULTING GROUP

Supply Chains That Become Real Value Chains

A New Mandate for Industrial
Supply-Chain Leaders Everywhere



INDUSTRIAL GOODS AND OPERATIONS



THE BOSTON CONSULTING GROUP

The Boston Consulting Group (BCG) is a global management consulting firm and the world's leading advisor on business strategy. We partner with clients from the private, public, and not-for-profit sectors in all regions to identify their highest-value opportunities, address their most critical challenges, and transform their enterprises. Our customized approach combines deep insight into the dynamics of companies and markets with close collaboration at all levels of the client organization. This ensures that our clients achieve sustainable competitive advantage, build more capable organizations, and secure lasting results. Founded in 1963, BCG is a private company with 85 offices in 48 countries. For more information, please visit bcg.com.

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If ever industrial companies needed top-notch supply-chain expertise and capabilities, they need them now.

There is one overarching concern that industrial executives share: the need to consistently deliver more value. Specifically, they are hunting for top-line growth and profitability and for ways to reduce volatility and risks far into the future. Concurrently, knowing the downstream impact of failing to supply crucial materials or components on time, they are redoubling their efforts to deliver reliably superior service levels.

Executives at industrial companies—regardless of sector—are looking to their supply-chain chiefs for answers. Once, best-in-class supply-chain practice was seen primarily as a means of containing the costs of goods sold, but today, it is viewed as a key contributor to faster time to

market, greater flexibility, better risk management, dependably higher quality, widespread customer satisfaction, and stronger revenue growth.

Put simply, there is a growing realization that supply chain excellence is the common thread that runs through every kind of value creation effort.

Awareness, however, does not automatically lead to action. Supply chain operations still fall short of best practice in many companies. The soaring complexity of supply chains, the relentless creep of regulation, the rising expectations of customers—these and many other factors combine to frustrate those striving to improve supply chain performance.

Today's supply-chain leaders need skills that transcend functional mastery.

Moreover, today's supply-chain leaders need skills that transcend functional mastery. They have to be—and be seen as—communicators, strategists, visionaries, and shrewd adjudicators who can make smart choices between often-conflicting high-value criteria such as reliability and supply chain flexibility.

This brochure is designed to start a conversation that will help executives attain superior levels of supply chain capability. In the next few pages, we describe the unique characteristics of industrial companies and outline the relevant hallmarks of supply chain excellence. We also provide glimpses of the supply chain frontiers of four industrial sectors.

In doing so, our intent is to lay the groundwork for discussions that will enable many more industrial companies' supply-chain

organizations to create enduring value. Our goal is to show what it takes to achieve supply chain mastery in a fully integrated, end-to-end way.

Those discussions should generate a host of detailed questions about strategies and processes, roles and responsibilities, assets and approaches, metrics and methods. The Boston Consulting Group has worked closely with many industrial companies to tackle such questions.

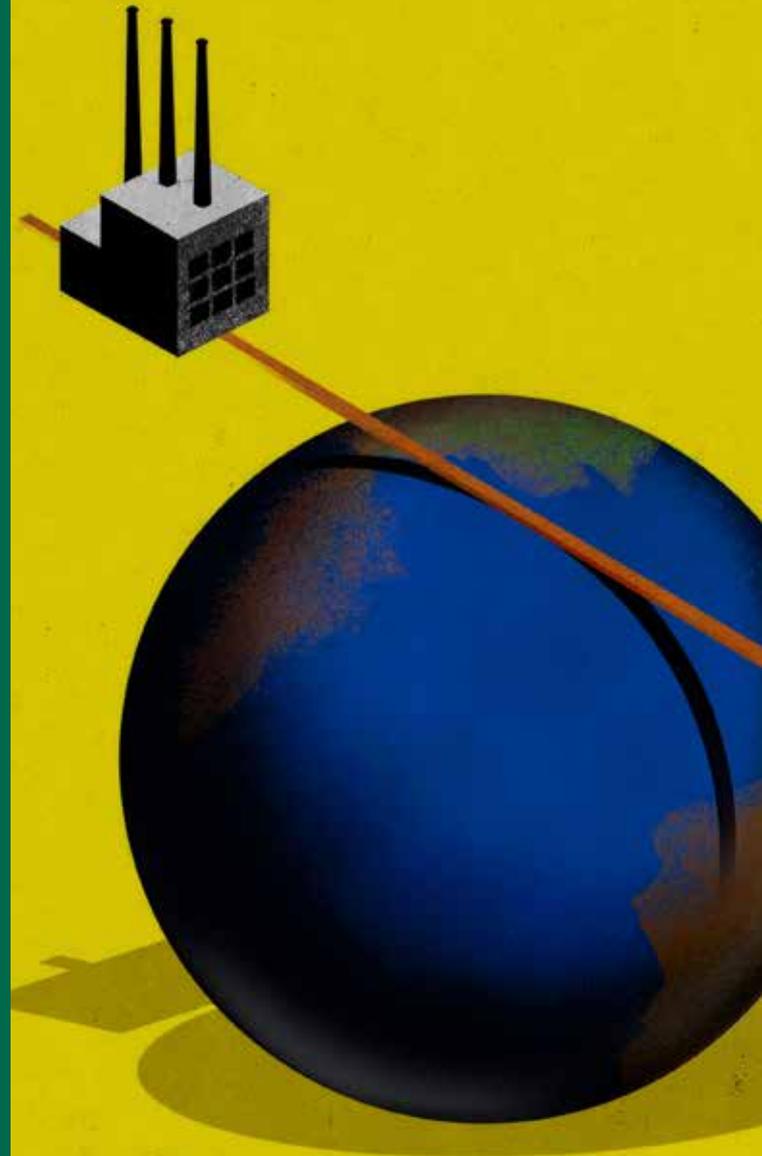
AN INTEGRATED APPROACH TO SUPPLY CHAIN EXCELLENCE

These days, supply chain excellence has many different meanings, each of which depends on the context. What works superbly well in, say, the pharmaceutical or consumer electronics sector is unlikely to make a lasting difference in industrial manufacturing (and vice versa).

In our work across industries and in many sectors within those industries, we have found the following to be characteristics of almost every industrial company:

- **High Fixed Costs.** Many industrial companies are highly asset intensive, and their profitability hinges on how effectively they utilize their assets. Achieving scale in production is crucial to asset utilization.
- **Strong Emphasis on Product Design.** For many manufacturers, increasingly complex product designs call for procurement, engineering, R&D, and quality to work far more closely together.
- **Long Product Life Cycles.** It's become clear that industrial companies can capture significant growth and enhanced profitability by properly managing the full life cycle of their products.
- **Complex Supply Base.** The products of many industrial companies require the integration of thousands of parts—in most cases, from a host of small and midsize suppliers around the world. Those long global supply chains add a host of new risks.

BCG has observed that some industrial companies understand the implications of these characteristics, and they align their strategies and operations accordingly. As a result, they outperform their competitors and demonstrate superior financial performance in the long run.



SIX TENETS OF SUPERIOR SUPPLY CHAINS

1

RUN A TRULY INTEGRATED
SUPPLY CHAIN.

2

SEGMENT SUPPLY CHAINS.

3

DRIVE ASSET EFFECTIVENESS.

4

ACTIVELY MANAGE MANY
TYPES OF RISK.

5

SUPPORT THE ENTIRE LIFE
CYCLE OF EACH PRODUCT
AND PLATFORM.

6

FOCUS FIRMLY ON QUALITY.

Six Tenets of *Superior Supply Chains*

Through our decades-long work in many different industries, BCG has identified principles that govern the success of the supply chains of industrial companies:

1 RUN A TRULY INTEGRATED SUPPLY CHAIN

These days, no supply-chain leader can succeed by focusing on procurement or logistics or any other discrete supply-

chain function in isolation. It is essential to see the supply chain as part of the broader process of value creation—value not just

DEFENSE CONTRACTOR BREAKS DOWN FUNCTIONAL SILOS AND WINS BIG NEW CONTRACTS

A leading defense contractor needed to reduce the overall price of its electronics system if it was to win a big government bid. The challenge was that one of the system's critical electronic components was extremely expensive. Furthermore, the contractor's procurement teams, by themselves, had little latitude to cut costs beyond the usual negotiations with the sole source of the component.

The company redesigned part of the system so that other suppliers could bid on an alternate component that would enable the system to deliver the same overall performance. This effort meant that procurement and engineering groups, which had rarely interacted previously, had to work as a team. The upshot: the cost of the replacement part came in 30% below that of the original component, lowering the overall system cost and allowing the defense contractor to win the sizable contract.

This new silo-breaking approach offers ongoing benefits. The contractor is now working to institutionalize the collaboration between its procurement and engineering groups. It is creating cross-functional teams and developing governance mechanisms and visibility in product development that will serve the company well far into the future.

for customers but also for the organization itself and all of its stakeholders.

That perspective calls for continually making trade-offs and taking into account the implications of every action on the rest of the value chain. This concept also requires close attention to the details of communication flows up and down

the supply chain—not just on the supply side but also, increasingly, on the customer side.

Today’s supply-chain exemplars are always aware of the linkages and interfaces within and beyond the supply chain: they know that more and more, that’s where the winning decisions are made. Put another way: that’s where the money is.

2 SEGMENT SUPPLY CHAINS

The supply-chain best-practice companies are well aware that there is no such thing as a one-size-fits-all supply chain. Supply chains can be—must be—

segmented by customer type, order type, or product type. In fact, they should be segmented by any category that makes business sense. The fundamental drivers

KEEP MORE CUSTOMERS HAPPY MORE OF THE TIME

A consumer durables manufacturer faced a tricky problem: its production operations could meet the needs of one group of customers, but it couldn’t manage the differing expectations of a range of customer categories. The priorities of private-label customers were not the same as those of large retailers, which were also different from those of large corporate customers.

The challenges intensified. Some customers prized fast delivery; others wanted premium-product reliability and were willing to wait for it. Often, products that were in line for shipment to a “reliability” customer were effectively hijacked by sales teams serving the “fast response” customers—sometimes just days before the order had been due to ship to the reliability customer.

Detailed analysis clearly revealed that the manufacturer was using pretty much the same supply-chain flow to serve all of its customers. The company changed its supply-chain approach, identifying and categorizing several customer segments and setting up discrete supply-chain rules for each. The result: improved customer service on all fronts.

of segmentation strategies: making the best use of assets and maximizing value creation for customers.

Johnson Controls, for example, has traditionally operated several different kinds of supply chains,

even within individual businesses. Some involve make-to-stock products; others involve make-to-order products. Each supply chain has to provide discrete service levels, and each level has its distinct strategy for inventory stock and, perhaps, for sourcing and for logistics as well.

3 DRIVE ASSET EFFECTIVENESS

In industrial-manufacturing settings such as steel mills and chemical plants, the name of the game is

asset utilization. The way to make money is to skillfully manage the life cycle of each installation of

LEADING STEELMAKER SQUEEZES MORE VALUE FROM EXISTING EQUIPMENT

Believing that many of its work centers were tapped out or nearing capacity, a leading steel maker began to examine its production processes in detail. Initial analysis revealed just how complex the company’s manufacturing processes were. There were many specific constraints, and many of those were in constant flux.

The company was able to extract more value from its assets in two ways. The first effort was a series of rapid-improvement manufacturing events. These efforts, which included speeding up equipment setups and throughput times, improved capacity by 5% to 20%. The benefits were most apparent in the work centers that the steel maker had thought were capacity constrained. Overall throughput across the company is now up 10%.

The second, longer-term effort involved increasing collaboration between the company’s production engineers and its commercial staff—a line of communication that hadn’t been well developed. This initiative began with development of a heat map depicting utilization rates for each work center. With the map it was easy to see where there was capacity to spare. Next, using sales-and-operations-planning processes, the company was able to bring production and commercial teams together to discuss how it could sell more of the product that could be made with the underutilized production assets the heat map had revealed. The steel maker now has a much clearer view of where it has pockets of capacity that can be monetized.

costly, critical machinery. Return on invested capital is an important metric of success.

The task of maximizing effectiveness becomes even tougher when companies have to manage multiple plants. (One industrial-seals manufacturer has more than 40 sites worldwide.) In such extensive and complex networks, it's typical that some plants are highly utilized and others have low utilization rates. The more plants in the network, the greater the risk of that disparity, which hurts the company's overall asset effectiveness.

That responsibility does not fall to the production engineers alone:

it lies also with the supply chain teams. Best-in-class supply-chain practice dictates that, in order to move more volume through, demand should be steered toward assets that have capacity, and the emphasis should be on debottlenecking work centers that are constrained.

This in turn requires in-depth experience in tracking, monitoring, analyzing, and reporting on data critical to the operation of all the equipment in question. Furthermore, establishing strong linkages with the commercial organization can yield significant benefits.

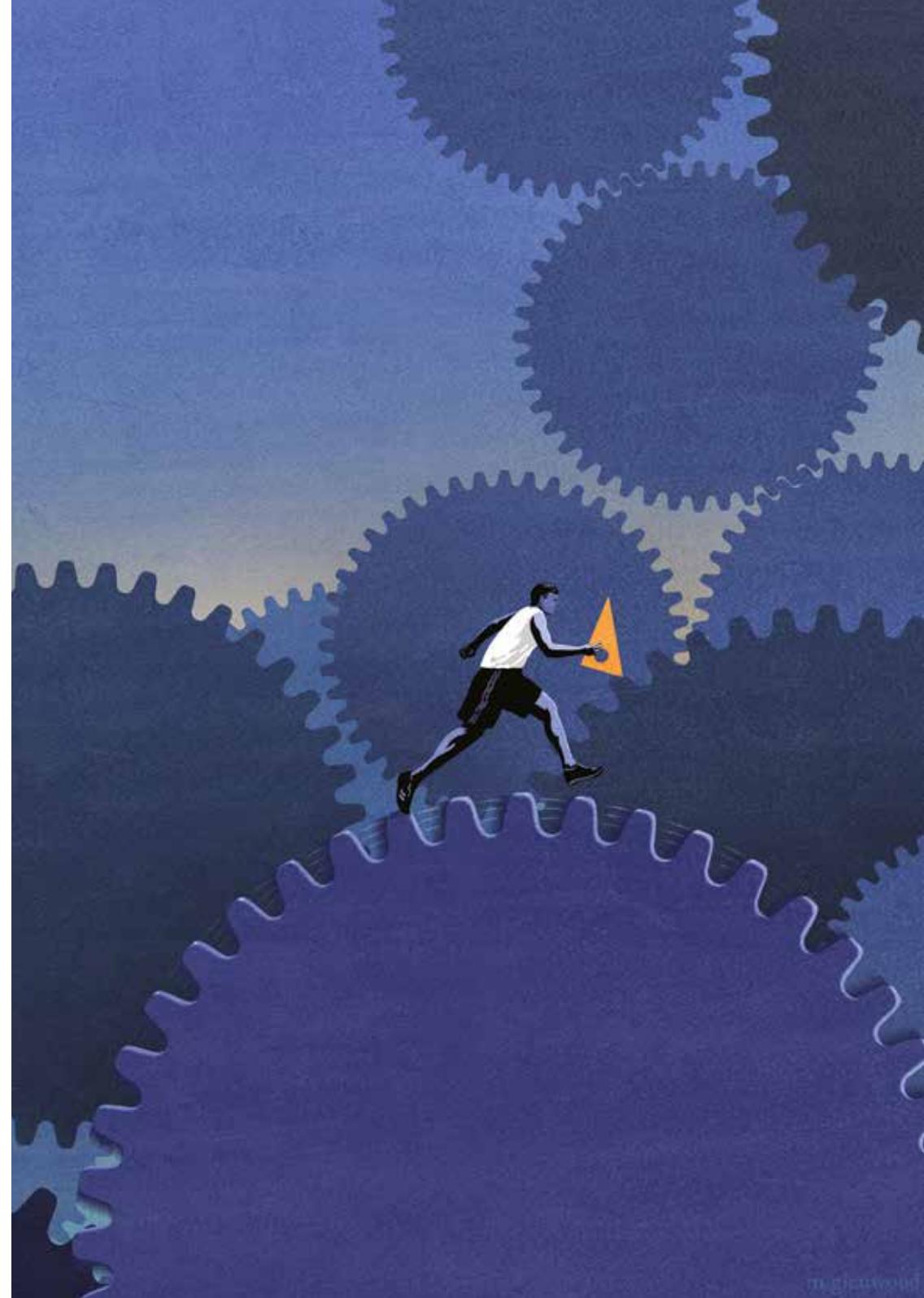
4 ACTIVELY MANAGE MANY TYPES OF RISK

It didn't take a tsunami on the other side of the world to make industrial business executives worry about supply chain risks. In the past few decades, there have been many alarming reminders of the risks associated with running an overly lean supply chain—or relying too heavily on sole suppliers.

The response, of course, is not to avoid all risks at all costs. Gone are the days of generous safety stock and excess redundancy in the supply chain. Today,

excellence in supply chain activities means carefully calibrated risk management, which involves gauging the discrete supply lines and channels that bear excessive risk, planning for and managing alternate approaches, and continually evaluating the trade-offs among such factors as cost, quality, performance, and speed.

Best-in-class supply-chain organizations also ensure that they have assembled robust contingency plans—even for



rare events. Knowing that it is far from easy to find and forge relationships with new suppliers in

an emergency, best-in-class players have preliminary arrangements in place.

MAPPING OUT SMART WAYS TO MANAGE RISK

The chief procurement officer (CPO) of a major aerospace manufacturer saw risks piling up fast. Not only was the company threatened by the same kinds of cyber attacks as most of its advanced manufacturing peers, but it was also exposed to such threats as the proliferation of counterfeit parts and the risk that a natural disaster might shutter a critical-component supplier.

The CPO began an initiative to manage and mitigate the risks. His first move was to categorize them. One category comprised risks that could drastically affect products and their respective programs—counterfeit spare parts, say, that could lead to airplane disasters. Another category, ecosystem risks, focused on threats to the company’s brand. A case in point: the sourcing, however accidental, of “conflict minerals,” such as tantalum from war-torn regions of Africa.

The company has built a “risk fortress” that starts with a very fine-grained understanding of supply chain tiers to expose points of vulnerability—back to original raw materials. That has led to supply-chain risk maps and the launch of pilot programs that help managers better identify, isolate, and manage risk all along the supply chain. In this way, the aerospace manufacturer has been able to significantly improve its supply-chain resiliency.

The company can now identify risks two years before they would create problems, and it can, therefore, take preventive action. Furthermore, it has successfully developed quick-response supply-chain capabilities for those times when unforeseen crises inevitably occur.

5 SUPPORT THE ENTIRE LIFE CYCLE OF EACH PRODUCT AND PLATFORM

Not long ago, supply chain leaders’ concerns ended when the customer’s truck left the loading dock. No more. These days, those leaders bear responsibility for supporting the business over the entire life cycle of the product or platform.

Multiple factors are driving things in this direction, but two factors in particular stand out. First, there is the reverse supply chain—the need to flow returned products back through the system. (Some leading auto manufacturers, such as BMW, are planning to reacquire, disassemble, and,

essentially, recycle cars they made years earlier.) Second, there is the growing awareness that there are significant profit pools to be captured in the aftermarket business.

Leaders at best-in-class manufacturers excel at developing, managing, and continually optimizing discrete supply chains for such scenarios. They take those structures into account when planning and managing long-term capacity.

A well-known case in point: Rolls-Royce, a manufacturer of

DRIVING UP LIFETIME PROFIT STREAMS

Several decades ago, many industrial-goods companies began to outsource all their aftermarket maintenance and support, aiming to improve returns on invested capital. Aftermarket maintenance and support was viewed simply as low-margin work and an inefficient use of capital. What wasn’t taken into account was that when another company handles maintenance, it is less likely to use new replacement parts made by the OEM. Those parts are actually the most profitable elements of an industrial product’s life.

Rolls-Royce was one of the first OEMs to set a new strategy that addressed this leakage of aftermarket profits. In 1990, the company maintained only 10% of its RB211 engines, which were a mainstay of airline fleets around the world. Throughout the 1990s, the company executed a program to get back into maintenance of these engines. For example, it formed a joint venture with American Airlines to maintain all the RB211 engines used on its jets. Essentially, it negotiated control of the service model in the shop and gained control of the parts flow. Today, Rolls-Royce performs about 80% of all service work on RB211 engines worldwide, and it has extended this operating model to its newer engines too.

gas turbines, has long benefited from the service component of its business, positioning itself as

the guarantor of engine uptime to the airlines whose planes use its engines.

6 FOCUS FIRMLY ON QUALITY

More than ever before, product quality, too, is a responsibility of supply chain leaders. Consider it part of the increasing integration of the role, as it threads among and between core industrial functions such as manufacturing and quality control.

Product quality is particularly relevant to industrial companies because many of them make products whose performance is critical at a life-or-death level: aircraft engine components or intensive-care medical equipment, for instance. Put simply, product

quality can be hugely important to industrials: just ask any of the automotive companies that recently sourced flawed air-bag components.

Indeed, many industrial companies whose purchases of substandard parts have led to production delays or customer backlash have found themselves in the glare

of unwelcome media coverage and worse. A few years ago, that was the case with a brand-name maker of personal computers. The company's supply chain was exposed as ineffective, and the outcomes are held to have contributed to the company's subsequent decline.

PINPOINTING WHAT AFFECTS PRODUCT QUALITY MOST

A manufacturer of specialty and nonferrous metals whose bars and other products are used in a variety of high-stress applications was finding it difficult to manage production cost-effectively.

In essence, the manufacturer was not easily able to control its cost of quality. With literally dozens of complex manufacturing steps needed to produce one specialty bar, the company was finding it tough to pinpoint the sources of its quality problems. Testing and more testing, often involving costly and very sophisticated equipment, was the order of the day, and the company was regularly scrapping entire batches of flawed product.

However, using proven analytics disciplines, the company was able to pinpoint the root causes of quality issues, identifying and measuring literally hundreds of process variables, from the temperature in the heat treatment furnaces to the acidity of the annealing baths.

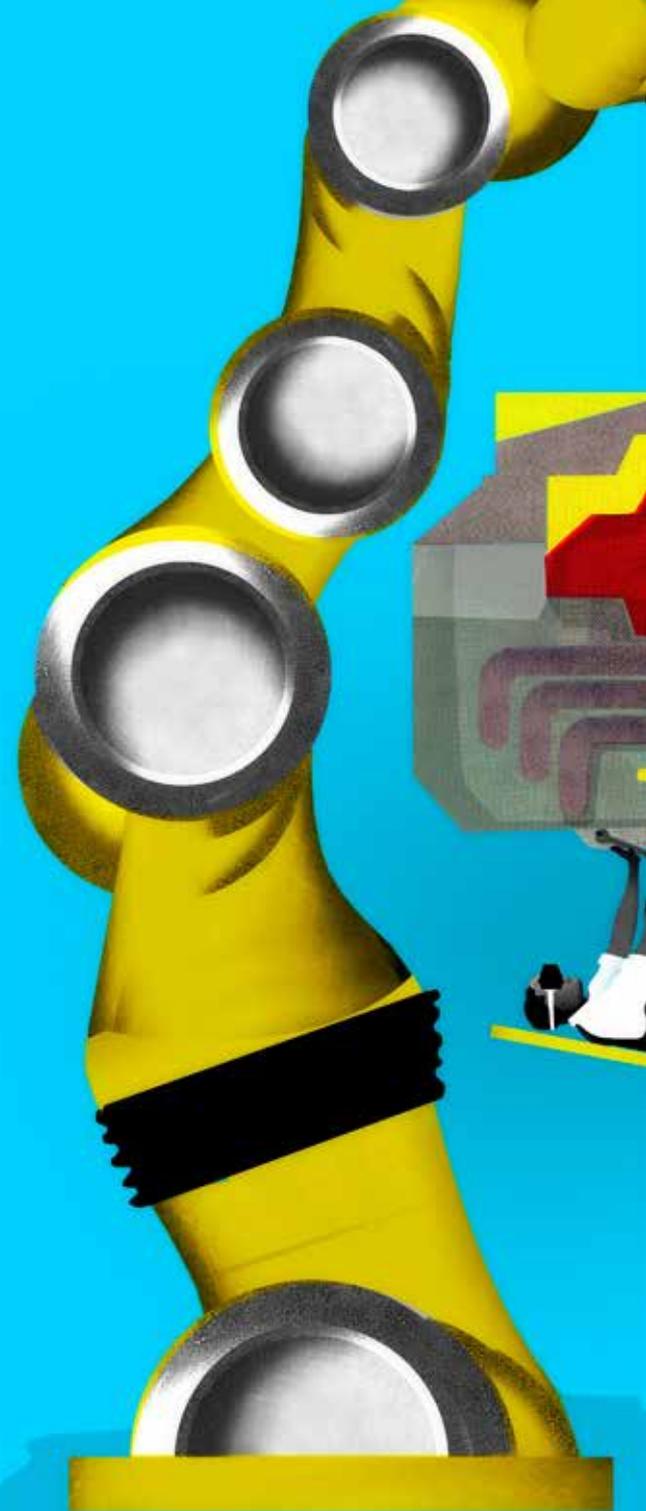
The metals manufacturer has also developed process quality dashboards—company-wide and in the business units—which managers can use to better control the cost of quality. The dashboards will be informed by the output from the root cause database that is now being populated with production process data. This steel maker is rapidly acquiring the analytical capabilities that will enable it to control its cost of quality—and thus its performance.

YOUR NEXT DECISIONS

For industrial supply-chain executives and for the other business leaders whose activities they influence, the mandate is clear. Supply chain excellence is defined by new criteria. It is no longer charted by the measures of earlier decades; it no longer pivots around discrete disciplines such as procurement and logistics. Now it is all about the integration of a range of supply chain disciplines, together with a deep focus on value, which is no longer tied only to delivering on time and producing cost savings.

Your next decisions should not be about whether or not that mandate applies to you or your organization. They should be about how soon you intend to act on that mandate—and what you'll need to be able to act.

This brochure offers an overview of what mastery of supply chain activities in industrial sectors really means today. To learn more about how BCG can help, please contact one of our experts.





Industry Snapshots

BCG has published a series of articles describing supply chain excellence in four industrial sectors. Here are snapshots of the topics we address:

- **Aerospace and Defense.** US prime contractors are being squeezed on both sides. On the customer side, the US government is demanding that contractors reduce the cost of their programs. On the other side, many suppliers have developed new business models that have seen them actually increasing revenues and margins. As a result, contractors need to take action to systematically wring costs out of their supply chains. In “A New Procurement Strategy for Defense Contractors,” BCG contends that a three-part approach can help: gaining better insight into supplier costs, applying leverage to existing suppliers to reduce costs, and generating an enterprise-wide view of the supply chain.

sharpened their ability to minimize logistics costs for specific routes. However, few have a big-picture view of their logistics networks and costs. Without this larger picture, companies might miss out on opportunities to capture maximum savings on logistics. In “Leveraging Big Data to Manage Logistics,” BCG explains that companies have five levers at their disposal to help build that picture, including determining the right mix of modes and routes, as well as consolidating shipments and optimizing their warehouse and distribution-center networks.
- **Metals Manufacturing.** Best-practice inventory management is essential to success in today’s competitive metals-manufacturing market. Excess inventory can conceal underlying operating issues such as production bottlenecks, poor-quality manufacturing, and overly

complex product portfolios. In “Metals Manufacturing: Four Rules for Managing Inventory Better,” BCG describes four ways to get control of excess inventory: keep it down (using multiple approaches to keep inventory levels to a minimum), keep it moving (scrutinizing manufacturing processes to help reduce cycle times and cut excess work-in-progress), keep it simple (working to minimize the complexity of product portfolios, for instance), and keep an eye on it (carefully monitoring inventory and applying and using proper metrics, for example.)

- **Automotive.** Hardly a month goes by without the announcement of yet another automotive recall affecting hundreds of thousands of

vehicles. Issues with air bags, seat belts, and electrical wiring are symptoms of a serious problem pervading the automotive supply chain: widespread failures of quality assurance. In “How Automakers Can Take Tighter Quality Turns,” BCG delineates the organizational reforms necessary to improve quality, align automotive OEMs’ quality-control systems with their chosen business models, and instill a quality-first mind-set in their organizational culture and design choices. These reforms present industry players with an opportunity to polish their reputations for quality and strengthen the trust of regulators, consumers, and investors in the safety and reliability of their products.

Read *All About It*

Our clients operate in nearly every industry and region around the world and they come to us for fresh approaches to the issues that matter most to them. Through a rigorous analysis of each client’s individual situation, we develop customized solutions that meet the organization’s specific needs. The examples here illustrate how we help clients sharpen their capabilities, create value, and deliver sustainable advantage.



The Proximity Paradox

Juggling demands for cost reduction and manufacturing close to the customer is one of the toughest management challenges the global auto-supply industry faces.



The Lean Advantage in Engineering

Although the benefits of lean engineering are clear, capturing them has proved difficult for many companies.



Dueling with Dragons 2.0

Multinational corporations in each industry are facing urgent challenges to their leadership from emerging-market players.



Man and Machine in Industry 4.0

The manufacturing world is experiencing a fourth wave of technological advancement: the rise of new digital industrial technologies collectively known as Industry 4.0.



Industry 4.0

We are in the midst of a fourth wave of technological advancement: the rise of new digital industrial technology known as Industry 4.0, a transformation that is powered by nine foundational technology advances.



Aerospace and Defense Value Creators Report 2015

As management teams look toward the next decades, they are asking fundamental questions about portfolios and cash deployment.

BCG'S INDUSTRIAL GOODS PRACTICE AT A GLANCE

BCG's Industrial Goods practice includes more than 245 partners and more than 500 consultants, as well as a network of external advisors and experts and a dedicated analyst and research team. The firm has extensive global experience across 85 offices in 48 countries.

- BCG's Industrial Goods practice serves six broad industrial segments: automotive, building materials, engineered products and infrastructure, metals and mining, process industries, and transportation and logistics. We help companies in these sectors think beyond the limits of their traditional business models, choose where and how they should add value, and reorganize to defend themselves against new threats and exploit new opportunities.
- We bring expertise to the operations value chain, including procurement and supplier negotiations, lean manufacturing, new-product development, supply chain optimization, working-capital management, and complexity reduction.

Meet Our Team

The following BCG experts represent a rich and diverse group whose experience comes from solving the critical supply-chain challenges faced by companies around the world. For every focus area, we also have local experts who provide pivotal insights into the dynamics of individual markets.



Claudio Knizek
Partner and Managing Director, Washington

Claudio Knizek has driven supply-chain improvement programs in a variety of industrial companies, particularly in the metals and engineered-products sectors.
knizek.claudio@bcg.com



Brian Myerholtz
Partner and Managing Director, Chicago

Brian Myerholtz supports the operations and strategy agendas of numerous engineered-product companies, focusing on supply chain management and product development.
myerholtz.brian@bcg.com



Thomas Peddicord
Partner and Managing Director, Washington

Thomas Peddicord works with aerospace and defense companies. His expertise is in operations improvement, including cost reduction programs in supply chain management and procurement.
peddicord.thomas@bcg.com



Greg Mallory
Senior Partner and Managing Director, Washington

Greg Mallory is the global leader of the firm's aerospace and defense sector. He is responsible for BCG's Industrial Goods practice in the Americas. His focus is on improving the operational and competitive positions of industrial companies.
mallory.greg@bcg.com



Amit Ganeriwalla
Partner and Managing Director, Mumbai

Amit Ganeriwalla is the global leader of the supply chain topic. He has worked with industrial companies around the world in sectors such as engineered products, cement, metals, and mining. His emphasis is on boosting his clients' performance through operational transformation.
ganeriwalla.amit@bcg.com



Robert Tevelson
Senior Partner and Managing Director, Philadelphia

Robert Tevelson is the global leader of the procurement topic area. He has dedicated his career to supply management improvement. He has helped industrial-goods and aerospace companies drive significant value from their external spending and improve their overall supply-chain operations.
tevelson.robert@bcg.com



Matt Aaronson
*Partner and Managing
Director, Chicago*

Matt Aaronson is the leader of the firm's aerospace and defense sector in the US. He has driven supply chain transformations across a range of OEMs and suppliers.

aaronson.matt@bcg.com



Brian Collie
*Partner and Managing
Director, Chicago*

Brian Collie is the leader of the automotive sector in North America. Over the past few years, he has led efforts to help various auto suppliers strengthen their quality infrastructure and transform quality into a source of competitive advantage.

collie.brian@bcg.com



Michelle Andersen
*Partner and Managing
Director, Detroit*

Michelle Andersen, who leads the firm's Detroit office, specializes in value chain improvements in the automotive industry. Her expertise is in assessment, design, and development of quality operating models in automotive and industrial-goods companies.

andersen.michelle@bcg.com



Andrew Loh
*Partner and Managing
Director, Toronto*

Andrew Loh works with capital-intensive businesses and focuses on operational topics, including capital project management, lean operations, and logistics optimization.

loh.andrew@bcg.com



Libor Kotlik
*Partner and Managing
Director, Düsseldorf*

Libor Kotlik works with a wide range of industrial companies on topics such as supply chain strategy, performance improvement, and large-scale supply-chain transformation.

kotlik.libor@bcg.com



Henry Caffrey
Principal, Chicago

Henry Caffrey works with a variety of industrial companies, in sectors such as automotive and aerospace. He focuses on operational transformations across the end-to-end supply chain.

caffrey.henry@bcg.com

For Further Contact

To reach BCG's Industrial Goods and Operations teams regarding insights or potential support, please visit <http://www.bcg.com/about/offices/default.aspx> for information on how to contact your local BCG office.

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