Lean Food-and-Beverage Manufacturing
Lower Costs, Better Products, Improved Sustainability
The Boston Consulting Group (BCG) is a global management consulting firm and the world’s leading advisor on business strategy. We partner with clients in all sectors and regions to identify their highest-value opportunities, address their most critical challenges, and transform their businesses. 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 69 offices in 40 countries. For more information, please visit www.bcg.com.
Food and beverage manufacturers have been accelerating their cost-cutting efforts to improve their profit-and-loss statements (P&Ls). The hunt for savings, spurred by structural changes in the industry such as the rise of private labels and discounters, became more urgent after the recession hit in 2008.

The economy is now recovering, and growth has become the new imperative. This requires new investments in R&D, product quality, advertising, sales, and pricing. Manufacturers are looking for ways beyond traditional cost cutting to create space in their P&Ls for investment. Although most manufacturers have continuous-improvement lean-advantage programs, lean manufacturing remains an underused approach. With limited capital expenditure, lean manufacturing used to its fullest can liberate large amounts of cash, fueling growth and improving quality with better, fresher, greener, and more delicious food-and-beverage products. It can also be a source of employee engagement and capability-building opportunities.

Some industry executives, however, have been skeptical. Recently, the chief operating officer of a major supplier that had already done plenty of cost cutting greeted a team of lean-manufacturing consultants from The Boston Consulting Group with a shrug, asking, “What can we learn from these guys? We have been doing this for ten years.”

Many lean programs tend to be limited exercises that produce one-off savings, leave most opportunities untapped, require larger capital investment, and do little to build employees’ engagement and capabilities. Lean manufacturing is regarded as more of an administrative function and lacks a real leadership or strategic role in the organization.

With the right approach, however, over a few intense months, workers at all levels can learn new ways to frame questions, find solutions, and improve continuously. These employees become ambassadors and champions for lean approaches, spreading knowledge and best practices from one plant to another. They also learn to focus their efforts, linking initiatives directly to monetary savings. Workers who have had this training do not see themselves as cogs in a machine that “delivers productivity increases.” They are members of a team that creates competitive advantage.

This approach is producing significant savings even in plants where managers thought there wasn’t much waste left. “I have to admit,” the skeptical COO said later, “that my attitude changed dramatically over time to ‘we really can learn something.’”

The opportunity is large. Manufacturers that use lean methodologies effectively can cut their cost of goods sold by as much as 3 percent. That corresponds to 20 percent of their addressable manufacturing cost base. Over the next two years, the top 100 food-manufacturing companies worldwide could save a total of $9.4 billion, and the top 70 beverage suppliers could save $4.2 billion—more than $13 billion of capacity waiting to be turned loose.

Discounters are gaining market share, and commodity prices are likely to rise. Suppliers, therefore, are feeling pressure to search for and cut non-value-adding costs. These are expenses that don’t make the product more valuable or attractive to customers. In a word, waste.

◊ The recession is changing consumer behavior. Shoppers have cut back on nonessential purchases. They shop for the best prices and wait.
for promotions. Discounters and private labels are grabbing market share and forcing suppliers to cut prices. In the United States, from 2007 through 2009, the market share of discount grocery stores grew from 33.2 percent to 35.2 percent. In Germany, during the same period, discounters increased share from 42.5 percent to 44.0 percent. (See Exhibit 1.)

- Suppliers face rising prices for materials. According to the Organisation for Economic Co-operation and Development, commodity prices could continue to increase at a rate of 5 percent per year.

- Pricing for inflation is becoming difficult. There is a growing risk that intense competition and tougher retailer negotiations will not allow suppliers to pass commodity price increases on to consumers.

- The need for stronger growth is again becoming critical. Many companies have refocused their incentives on stronger growth targets and are searching for new ways to finance the higher cost of products, advertising, sales, and pricing actions.

- Green production strategies are becoming sources of competitive advantage. Governments, customers, and employees are increasingly pushing companies to reduce material, water, and energy waste.

**The Maturity Stages of Lean Manufacturing**

Manufacturers, of course, have not been asleep while all this has been going on. They have optimized processes, reduced head count, played with cheaper recipes, and hired consultants. What few did, however, was attempt to identify all non-value-adding manufacturing costs in a holistic way.

Many lean programs generate efficiencies but miss the largest potential savings levers. Some focus only on the shop floor. Others lack the ability to maintain momentum (and keep the attention of top management) by tracking improvements precisely and linking them to financial results and corporate strategy. Some require large capital expenditures. Others focus only on big-ticket items that represent only 30 to 40 percent of savings. Many do not strive to make continuous improvement a real mindset among all employees in manufacturing.

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**Exhibit 1. Manufacturers Are Under Pressure**

<table>
<thead>
<tr>
<th>Year</th>
<th>United States</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>33.2%</td>
<td>42.5%</td>
</tr>
<tr>
<td>2008</td>
<td>34.0%</td>
<td>43.0%</td>
</tr>
<tr>
<td>2009</td>
<td>35.2%</td>
<td>44.0%</td>
</tr>
</tbody>
</table>

Sources: GfK ConsumerScan, May 2009; Planet Retail; company financial statements; IMF Food Commodity Price Index; OECD-FAO Agricultural Outlook 2009–2018; BCG analysis.

1Weighted-price index for wheat, maize, rice, vegetable oils, butter, cheese, whole-milk powder, and raw sugar.
We have identified four main stages of lean manufacturing at food and beverage companies. (See Exhibit 2.) They span a continuum from companies that have added a few lean techniques to their operations to those that have completely integrated “lean” into their culture and use it as a real source of competitive advantage. Most manufacturers reap the benefits that come with reaching Stage 1, Stage 2, or Stage 3. Only a few, however, keep going and reach Stage 4.

**Stage 1: Force for Modest Change.** The majority of food and beverage manufacturers are in this stage. Manufacturing delivers the requested products and productivity. There is an established lean function, but its effectiveness is narrowly limited. Companies in this stage do not have a clear picture of their non-value-adding manufacturing costs. Although they may have a strong recent track record of productivity gains, they lack straightforward measures for reducing non-value-adding manufacturing costs and tend

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### Exhibit 2. There Are Four Stages of Maturity in Lean Manufacturing

<table>
<thead>
<tr>
<th>Stage</th>
<th>Business Driver</th>
<th>Danger of Missing the Goal</th>
<th>Danger of Falling Back</th>
<th>Danger of Resting on Past Success</th>
<th>Danger of Falling Back</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Force for modest change</td>
<td>Regular productivity savings</td>
<td>No transparency of non-value-adding costs</td>
<td>Few central continuous-improvement managers</td>
<td>Best practices documented but not broadly implemented</td>
</tr>
<tr>
<td>2</td>
<td>One-off business driver</td>
<td>Quantum leap in productivity, mostly funded by capital expenditures; OEE below world-class</td>
<td>Limited transparency of non-value-adding costs</td>
<td>Strong cross-functional teams but limited leadership</td>
<td>Some flow of best practices</td>
</tr>
<tr>
<td>3</td>
<td>Sustained-improvement contributor</td>
<td>Manufacturing as a major source of free cash; non-value-adding costs reduced by more than 50 percent; limited use of capital expenditures</td>
<td>OEE at or above world-class level; bottlenecks cleared to avoid capital expenditures for new lines</td>
<td>Strong, cross-functional teams with clear leadership; most line managers trained</td>
<td>Continuous flow of best practices; broad implementation</td>
</tr>
<tr>
<td>4</td>
<td>Source of competitive advantage</td>
<td>Repeated quantum leaps; fresher, tastier products; younger stock on retail shelves</td>
<td>Non-value-adding costs almost completely eliminated; OEE above world-class level</td>
<td>Most lines on SMED; highest production flexibility; 5S sustained in all plants and lines</td>
<td>Continuous flow and widespread implementation of best practices; obsession with solving root cause problems, asking, how can we become better?</td>
</tr>
</tbody>
</table>

**Value added by a rigorous lean transformation**

- Regular productivity savings
- OEE 10 to 20 percentage points below world-class
- No transparency of non-value-adding costs
- Few central continuous-improvement managers
- Best practices documented but not broadly implemented

**Point of transformation**

- Quantum leap in productivity, mostly funded by capital expenditures; OEE below world-class
- Limited transparency of non-value-adding costs
- Strong cross-functional teams but limited leadership
- Some flow of best practices

**Sources:** Press searches; company Web sites; BCG’s lean advantage topic area; BCG analysis.

1. OEE = overall equipment effectiveness.
2. SMED = single-minute exchange of die.
to rely on capital expenditures to hit productivity targets. While many have designated continuous-improvement managers, those managers have to fight to put their ideas into practice. They are seen more as administrators than as forceful continuous-improvement leaders.

The 5S workplace-organization approach is implemented only in isolated areas. Bottleneck analyses are done occasionally. Manpower levels on some lines have been analyzed closely, but many lines have not been scrutinized. Overall equipment effectiveness (OEE) averages are 10 to 20 percentage points below world-class levels.

**Stage 2: One-off Business Driver.** We found few companies at this level. These companies already have a long-established lean practice that has been able to show strong one-off business improvement. They have a database of best lean practices, but, somehow, results do not really stick. The results lack sustainability. Management continues to request strong productivity improvement in manufacturing, but the role of lean has become more limited over time. Most productivity increases originate outside the lean organization. Many require large capital-expenditure initiatives.

These companies have a good track record of lean workshops with improvement team members of different backgrounds. They have displayed key performance indicators (KPIs) and best practices on the shop floor. In a few pilot plants, they have achieved great benefits, but the energy behind the lean initiative is gone. There is no ongoing flow of best practices. After a short period, these companies risk falling back to Stage 1: they are not able to sustain energizing momentum. They have methods in place for identifying non-value-adding manufacturing costs but not in each plant or across all lines. They do not set clear targets by plant and by line for non-value-adding costs. They may lack the tools or the culture. In some situations, they simply lack manpower and the necessary engagement of senior management. Some lines still have OEE well below optimal levels.

**Stage 3: Sustained-Improvement Contributor.** Few companies are in Stage 3. These companies work consciously to transform their entire culture into one of continuous, sustained improvement. They have big specific targets for each plant and line to reduce non-value-adding costs with limited capital expenditures. Manufacturing is a major source of free cash, improving net working capital with flexible production lines that support frequent changeovers and reduce inventory. Products made by these manufacturers are younger on the retail shelf than those of competitors. Enabled local lean champions are key to spreading lean culture throughout the organization.

Decentralized continuous-improvement managers can focus on long-term continuous improvement. Many plants consistently apply 5S, OEE is at world-class levels, and lines are nearly fully utilized. There is a continuous flow of new best practices and internal competition to eliminate non-value-adding costs. These companies are clearly above average standards, but they need to be careful not to become complacent.

**Stage 4: Source of Competitive Advantage.** Stage 4 requires embracing Stage 3 characteristics and going one step further to set up supply-chain and lean initiatives as true sources of competitive advantage. Companies at this stage build a culture of continuous improvement. They have a complete view of non-value-adding costs, having reduced them by 50 to 80 percent. They have gained organizational agility. They continuously and systematically ask, how can we become better? They focus on delivering the freshest products at the lowest cost and with the highest flexibility. Most plants and OEE lines meet global best-in-class standards.

Manufacturing is a key contributor to funding growth. Because changeovers are short (less than ten minutes), lines produce small batches of fresh products and generate limited inventory. With short changeovers, complexity becomes less of an issue. Cross-functional teams work closely together on a daily basis and regularly deliver improvements in performance. They show their results directly to the CEO. Only a few companies reach this level, and even those companies need to be careful always to walk the extra mile.

The answers to a few focused questions can reveal which level a company has achieved—and how much more it could do. (See the sidebar “Lean-Manufacturing Self-Assessment.”)
1. How would you describe the role and perception of manufacturing in your organization?
   a. It delivers the products requested by central planning, and regular productivity savings are defined from the top down.
   b. We have seen a quantum leap in productivity. However, the change was driven mainly by capital expenditures.
   c. We are actively using alternative production methods: manufacturing is continuously a strong source of increased profits and frees up cash.
   d. It is one of our core sources of competitive advantage: we are able to produce fresher, tastier products than our competitors, and our conversion costs are much lower.

2. How do you control your non-value-adding costs?
   a. We don’t see all of our non-value-adding manufacturing costs.
   b. We see only some of our non-value-adding manufacturing costs.
   c. We frequently analyze our non-value-adding manufacturing costs. We know the potential of each of our factories.
   d. We have a sophisticated system in place to identify and control non-value-adding manufacturing costs. We know the costs of each SKU and line.

3. On what part of production are your continuous-improvement initiatives focused?
   a. We try to solve a problem when we find it.
   b. We try to focus on our major non-value-adding costs.
   c. On the basis of our analyses of non-value-adding manufacturing costs, we know where to focus our efforts.
   d. We have a systematic process in place for identifying non-value-adding manufacturing costs, analyzing their root causes, and implementing solutions. On the basis of the size of a non-value-adding manufacturing cost and the cost of fixing the root cause, we focus first on the non-value-adding manufacturing cost with the highest payback.

4. To what extent are productivity initiatives linked to financial savings?
   a. If we need to make a major capital expenditure, we prepare a business case.
   b. The financial benefit of each initiative is always calculated before implementation.
   c. Before we get too deep into fixing a root cause, we work to understand its financial-savings potential. Only if the savings potential is big enough, do we continue to focus on fixing a root cause.
   d. We select initiatives for implementation from our pipeline of initiatives whose productivity and costs we’ve calculated; we can track the P&L impact.

5. What are your ambitions for batch sizes and changeover duration?
   a. We try to maximize batches in order to avoid changeovers. Over the past three years, we’ve improved changeover duration by 30 percent.
   b. Depending on the line, we maximize batches in order to avoid changeovers. In pilot programs, we have deployed leveled production to make it easier to plan changeovers. In the past year, we have improved changeover duration by 50 percent.
   c. Using leveled production, we have reduced changeover duration by more than 80 percent. Many changeovers take less than ten minutes. Changeover is no longer a key factor when we decide on batch size.
   d. Most of our changeovers take less than ten minutes, so we can act with the highest flexibility.

6. To what extent is 5S implemented in manufacturing?
   a. 5S is implemented only in isolated areas; initiatives are driven by the central organization.
b. SS is implemented in several pilot areas. Operators understand the benefits of SS.

c. SS has been rolled out in all of our plants and for all lines.

d. SS has been rolled out in all of our plants and for all lines; SS is sustained and regularly checked by operators in all plants.

7. How has capability building been organized in your company?

a. A continuous-improvement manager is in an administrative role to enhance basic lean knowledge. This person is fighting to get the organization involved and enabled.

b. We have teams trained in basics such as root cause identification, value stream mapping, and Pareto analysis. More than 30 percent of our line managers are already trained, and we have a system of “snowballing” to guarantee that the learning effect reaches down to the operators.

c. We have a decentralized continuous-improvement organization, which is responsible for applying lean tools to implementing initiatives. Most line managers are trained in lean approaches.

d. We have an obsession with finding root causes and solving those problems. How can we become better? Is a question we are always asking ourselves. The continuous-improvement function is integrated in the line organization.

8. Who in the organization is the challenger and sponsor of continuous improvement in manufacturing?

a. It is driven by the plant managers, so continuous-improvement results vary considerably among plants.

b. It is sponsored by the head of manufacturing, who is always challenging the results.

c. It is sponsored by the regional or category head.

d. It is sponsored by the head of the region or category. Our CEO gets regular updates on our results and has a genuine interest in pushing continuous improvement even further.

9. How are key performance indicators (KPIs) used within manufacturing?

a. We are tracking some KPIs; the tracking is mostly backward looking.

b. KPIs are used and posted on the shop floor every day.

c. KPIs are used uniformly and systematically and are centrally tracked.

d. KPIs are used uniformly and systematically and are centrally tracked and linked to central business requirements.

10. How is best-practice sharing organized among plants?

a. Best practices are documented, but the system is old and not broadly implemented.

b. Best practices are documented and, to some extent, shared among plants.

c. There is a continuous flow of best practices among plants and broad implementation.

d. We have a systematic strategy for creating a continuous flow of best practices; most best practices are widely implemented within a very short time frame.

A majority of “a” answers indicates that your company’s continuous-improvement effort is in Stage 1: Lean is a force for modest change. A majority of “b” answers indicates that your company is in Stage 2, utilizing continuous improvement as a one-off business driver. A majority of “c” answers indicates continuous improvement as a sustained-improvement contributor—Stage 3; your company may, however, face the risk of falling back if it does not continuously refine and renew its programs. A majority of “d” answers indicates that your company has made continuous improvement a source of competitive advantage; even at Stage 4, however, a company cannot risk resting on past success.
BCG believes that about 80 percent of companies have achieved Stage 1 or Stage 2. Some leading-edge companies—mostly market leaders in their categories or small specialized players—have reached Stage 3. It is important to note that the stages do not represent an assessment of the manufacturing people involved but rather an articulation of the company’s ambition to achieve lean-manufacturing results. Within each stage, some companies perform better or worse relative to this expectation.

**Big Ambitions and Specific Goals**

There is no one-size-fits-all approach to rolling out an effective lean program. Every company has its own culture. There are, however, three things that transformative lean efforts have in common.

- They generate significant **measurable** impact (on, for example, costs, inventory, and customer satisfaction) with limited capital expenditures
- They create real momentum for change within the organization, with improvement efforts linked directly to corporate strategy
- They enable the organization to improve continuously

The structure of the food and beverage industry presents special challenges to achieving those goals. Most manufacturers have a large number of plants, so a culture-changing lean program must be rolled out simultaneously in many places. The high complexity of many food-and-beverage plants—multiple lines, multiple SKUs—requires thorough preparation and a clear focus on key savings targets.

The goals of lean manufacturing are cultural and financial. Its immediate targets are seven sources of waste.

- **Overprocessing.** Manufacturing products whose quality is higher than customers want or will pay for.
- **Overproduction.** Making products that end up in inventories or as scrap. In food and beverage manufacturing this often takes the form of overfilling or “overweighting.” Generally, food and beverage products are sold by weight or volume. Some products, however, exceed their required minimums by as much as 20 percent.
- **Transportation.** Creating unnecessary movement of materials, tools, and spare parts within a plant.
- **Motion.** Requiring unnecessary movement of the product and people during production.
- **Inventory.** Ending up with excess inventories that increase warehouse and other costs. For perishable food and beverages, lower inventories not only save money and reduce workload, they also lead to fresher products. Fresher products can improve customers’ perception of quality.
- **Defects.** Scrapping or reworking products, which generates additional labor, material, and packaging costs. In the food industry, many failures and defects can be reworked. This is good because reworking reduces the loss of raw materials, but it’s also bad because it can make eliminating root causes seem less than urgent.
- **Waiting.** Allowing time-wasting technical failures, improperly balanced lines, and poorly managed operators.

**Enabling: Training the Trainers**

Enabling is at the core of an effective lean approach. External experts don’t change companies. Workers do. Employees are trained in lean as they begin finding waste. As they learn, they become ambassadors for the concept throughout the company. Over the course of three or four lean workshops, employees develop lean skills and learn to lead the program and train other employees.

Most food-and-beverage manufacturers are large operations, spread out over wide areas, with—compared with other industries—small plants in terms of value creation and number of employees. Such companies change much faster when initiative comes from empowered local employees instead of a centralized bureaucracy.

A BCG lean initiative starts with a series of three- to five-week kick-start workshops for about 20 participants each. At first, the BCG team works closely with management to help push change, helping the client con-
duct training and shop-floor observation sessions, as well as moderating analysis discussions. If a line changeover has already been cut from 120 minutes to 40 minutes, for instance, the team might ask, what could get the time down to 8 minutes?

Over the course of six to eight kickstart workshops, BCG’s role shifts to one of support. Employees who are designated “lean-program experts” take over leadership, supported by six to eight “shared lean champions,” employees who have previously participated in at least two transformation kickstart workshops, the first at a location other than their home plant. (See Exhibit 3.)

Each participant takes on more responsibility with each additional workshop. Employees who were team members in their first workshops should take a leading role in some topics in their second. By their third or fourth, they should be able to train others in lean methodology and drive the transformation.

The kickstart workshops themselves have several core elements. They include basic training, learning by doing and owning responsibility, coaching and feedback, and support materials.

◊ **Basic Training.** Each future lean-program expert needs a thorough understanding of lean methodologies and tools. During the transformation kick-start workshops (and special lean-program expert-training sessions in consolidation weeks between kick-start workshops), future lean experts are trained in lean theory. All participants have training sessions focused on the main lean levers. These are interactive sessions, comparable to the case study reviews conducted by graduate students of business administration. The daily sessions are followed each day by practical observation sessions on the shop floor.

◊ **Learning by Doing and Owning Responsibility.** To speed the spread of lean methods throughout the organization, employees “learn by doing.” They hunt for waste. A kick-start workshop is not just training. Each has a clear savings target, and it is the responsibility of each kick-start team to reach its target. Throughout, the team is doing real work, making hundreds of measurements, gathering data, and analyzing processes to get to the real root causes of waste.

◊ **Coaching and Feedback.** Over time, BCG’s role shifts from leader to coach. In daily sessions, progress is evaluated and plans for coming days are discussed. Each kickstart week ends with a feedback ses-

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**Exhibit 3. A Handoff Approach Builds Internal Capabilities and Shifts Responsibility to the Client Team**

<table>
<thead>
<tr>
<th>Project ownership</th>
<th>Change agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive change</td>
<td>Owner</td>
</tr>
<tr>
<td>Joint design</td>
<td>Client team</td>
</tr>
<tr>
<td>Preparation and data collection</td>
<td>Coach or trainer</td>
</tr>
<tr>
<td>Owner</td>
<td>Client team</td>
</tr>
<tr>
<td>Coach or trainer</td>
<td>Client team</td>
</tr>
<tr>
<td>Support</td>
<td>BCG</td>
</tr>
</tbody>
</table>

Source: BCG analysis.
sion in which all participants focus on two questions: What went well? What could have been better? One-on-one sessions are held as needed to identify areas for improvement.

◊ Support Materials. With team members, BCG develops customized comprehensive handbooks for all participants. These explain the overall process and give detailed guides for each lean lever. Lean champions train to become trainers themselves as they implement lean tools. By the end of three or four kick-start workshops, a critical mass of employees has been trained.

Lean Levers: Key Savings Areas

Lean-program experts and champions master the details of several interrelated levers critical to savings in the food and beverage industry. These levers include optimizing manpower levels on lines, reducing bottlenecks, and optimizing fixed costs. They are also immersed in finding savings by, for example, raising OEE, improving material yield, and reducing inventory. (See Exhibit 4.) Furthermore, these levers focus on reducing the company’s carbon footprint.

Raising Overall Equipment Effectiveness. A systematic lean approach can generate OEE improvement of 5 to 15 percentage points. OEE is a measure of the total output of a manufacturing unit (a machine or line) based on its theoretical speed. Improving OEE results in higher output per unit of time. This helps reduce labor and energy costs, decreases inventories, and increases capacity. (See the sidebar “A Lean Win: Big Efficiencies, Small Capital Expenditures.”)

In food manufacturing, there is an important difference between processing and packaging units. The OEE of processing units is generally superior to that of packaging units. BCG’s OEE benchmarks for processing units puts the world-class level at 95 percent; for packaging units, the comparable level starts at 85 percent.

For beverage lines, which are often highly integrated, a score over 80 percent is world-class. BCG estimates that less than 10 percent of all food-and-beverage units reach optimal levels. (See Exhibit 5.)

The industry has distinct obstacles to maximizing OEE. Given the high seasonality of demand, many production lines face capacity constraints only a couple of weeks or months per year. The rest of the time, OEE-related losses can be made up simply by extending pro-

Exhibit 4. Six Important Levers Within the BCG Framework Address the Cost Base and Increase Savings

<table>
<thead>
<tr>
<th>Lever</th>
<th>Typical improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimizing manpower levels on lines</td>
<td>from 15 percent to 40 percent</td>
</tr>
<tr>
<td>Reducing bottlenecks</td>
<td>from 10 percent to 30 percent</td>
</tr>
<tr>
<td>Raising OEE¹</td>
<td>from 10 percent to 30 percent</td>
</tr>
<tr>
<td>Improving material yield</td>
<td>from 20 percent to 40 percent</td>
</tr>
<tr>
<td>Optimizing fixed costs</td>
<td>from 15 percent to 25 percent</td>
</tr>
<tr>
<td>Reducing inventory</td>
<td>from 20 percent to 30 percent</td>
</tr>
</tbody>
</table>

Source: BCG analysis.

¹OEE = overall equipment effectiveness.
In 2009, a major international food-and-beverage manufacturer retained BCG to introduce lean manufacturing into some of its European plants. The company’s management doubted that there was much waste left in its lines but had hypothesized that improving overall equipment effectiveness (OEE) might be one powerful lever.

A production line on which jars of a powdered breakfast drink were filled and then packaged had been running for two years, during which time the operators had made large capacity improvements. After gathering performance data, observing the line, and talking with operators and maintenance-and-repair technicians, a lean-manufacturing kick-start team determined that the filler unit ran at a significantly lower capacity than the rest of the units on the line, creating a bottleneck.

A special team, comprising one lean expert and two local champions, conducted a deep root-cause analysis of the filler. The team noticed that the screw conveyor used to feed the product into a hopper had only two modes—on and off. The problem was that when the screw conveyor was on, it fed the product too fast. That led to overfilling that stopped the line about once every 25 seconds. A bottleneck was the result of low overall asset utilization that had not been challenged before.

Adding an inexpensive frequency converter to the screw conveyor made its speed adjustable. At lower speeds, the screw conveyor no longer overfilled the hopper, and the frequent stoppages were eliminated. An investment of less than $1,000 increased the speed of the line by 17 percent, generating payback in less than a week. In the end, the original OEE loss analysis turned into a classic bottleneck analysis.

### Exhibit 5. The Beverage Sector Has the Lowest Overall Equipment Effectiveness

<table>
<thead>
<tr>
<th>Benchmark target</th>
<th>OEE1</th>
<th>Food processing</th>
<th>Food packaging</th>
<th>Beverages2</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥95%</td>
<td>74%</td>
<td>90%</td>
<td>95%</td>
<td>74%</td>
</tr>
<tr>
<td>≥85%</td>
<td>83%</td>
<td>79%</td>
<td>85%</td>
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<tr>
<td>≥80%</td>
<td>90%</td>
<td>67%</td>
<td>74%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Source: BCG analysis.

1OEE = overall equipment effectiveness.
2Includes the returnable-bottle business.
duction hours. Similarly, the ability of food and beverage suppliers to rework some defective goods without material loss can also help disguise low OEE levels.

The industry also faces strict quality and legal requirements related to sanitation and cleaning. Certain internal quality requirements are linked to frequency and length of cleaning rather than to the required level of sanitation. Many such requirements can be challenged without compromising safety or quality.

For example, cleaning in place (CIP)—a standard method of cleaning pipes, tanks, and filling equipment—involves rinsing detergents through parts of the line. This process has several cycles and is highly automated. CIP can be accelerated by using sensors to measure, for example, the amount of dirt or the concentration of detergent in the cleaning liquid. This can eliminate unnecessary cycles, shortening sanitation time and saving on chemicals and water.

Another obstacle to achieving maximum OEE levels is complexity. It is not unusual for a single line to produce more than 30 different SKUs with a changeover—and often cleaning—required before each switch. A high number of changeovers tend to reduce OEE, particularly because so little food-and-beverage machinery is designed for easy changeover.

Finding out what drives losses is key to addressing low OEE levels. Pareto analysis is based on the idea that a great many failures are generated by a proportionately small number of causes. Some of these causes can be identified by devices that measure microstoppages too brief for operators to notice. Root causes can often be identified in workshops and brainstorming sessions in which line operators, team leaders, and maintenance and repair technicians visualize losses per manufacturing unit.

A systematic lean approach can cut material losses by 20 to 40 percent.

Another well-known tool to improve OEE is the single-minute exchange of die (SMED) approach, which Toyota originated to reduce changeover times. While SMED is well known in the industry, it is rarely applied systematically and comprehensively.

Many machines in the food and beverage industry are not designed for easy changeover; SMED techniques can simplify complex changeover processes. BCG’s experience shows that even on lines with previous significant changeover-time reductions, a systematic SMED approach can cut changeover times by as much as 50 percent.

Improving Material Yield. A systematic lean approach can cut material losses by 20 to 40 percent. In food and beverage manufacturing, raw and packaging materials represent a large part of the cost of goods sold, from about 50 percent in plants producing “simple” products such as mineral water to 80 to 90 percent in plants that require costly raw materials, such as coffee and chocolate.

There are three main drivers of raw- and packaging-material costs: standard consumption, scrap, and overfilling or overweighting. Scrap and overfilling or overweighting are often responsible for 2 to 5 percent of total material costs. Food and beverage products are sold by weight or by volume units, with strict legal-minimum requirements.

The challenge producers face is to meet those requirements without exceeding them. While scrap can usually be detected visually, overweighting and overfilling are often trickier to detect. Some products weigh as much as 20 percent more than the required minimum.

Overweighting and overfilling are the result of variability in filling and packaging processes. A powerful lean tool to reduce variability is statistical process control, which monitors variation in order to distinguish between common and special causes. Common causes are sources of “natural” or random variation. Special causes are irregular and unstable sources and can lead to processes running out of control.

Scrap can be reduced at two points: where it is first generated and where rework is scrapped. For the first, it is important to understand which SKUs generate scrap. A Pareto analysis of each SKU’s annual value of scrap shows that most of the scrap is produced by only a few SKUs. Once those are identified, a focused root-cause analysis can be done. A useful tool here is an hourly scrap-tracking system. This can help operators visualize technical defects.

Although it is often possible to rework finished or semifinished goods that don’t meet quality requirements, the limited shelf life of food
products, as well as recipe restrictions on the maximum permissible volume of rework, can force manufacturers to turn rework into scrap. For some products, as much as 50 percent of rework is scrapped.

For rework that ends up as scrap, the pattern is often the same: a few SKUs generate the majority of the rework. In food and beverage manufacturing, there are two main reasons why rework is turned into scrap: recipe limitations on rework and limited shelf life. The recipe limitation is usually based on quality concerns or allergen-content declaration requirements. Allergen content requirements are untouchable.

However, most quality limitations on rework are established during R&D. Limits on most cross-work—the rework of one SKU into the recipe of another—are also set during R&D. A close look at maximum levels of rework and cross-work, however, often reveals different standards applied to similar SKUs in different plants. Adopting consistent standards and working with R&D to increase the maximum level of recipe rework or cross-work can significantly decrease scrap levels.

Most limitations on cross-work are set to reduce the number of items on the contents list. Case-by-case discussions with marketing, quality control, and R&D about increasing the number of items contained in specific SKUs without affecting quality or allergen content requirements can provide opportunities for cross-working.

Reducing Inventory. A systematic lean approach can cut inventories by 20 to 30 percent. The logic behind reducing inventories of finished goods in all industries is identical: it is to free up working capital. In the food and beverage industry, in which most products have a limited shelf life, there is an additional incentive: inventory reduction means fresher products. Fresher products promote the perception of higher quality, and that can be a competitive advantage.

Inventory reduction can be achieved in three ways: decreasing cycle times, minimizing variability, and reducing safety stock.

Cutting changeover times to produce a company’s main SKUs more frequently can reduce cycle times without a negative impact on OEE. By using lean tools to reduce changeover times, average cycle times can be reduced by 40 to 50 percent.

Heijunka, a Japanese term for production leveling or smoothing, is a lean-manufacturing tool for reducing the number of changeovers and making them more predictable. Its objective is to reduce all kinds of production fluctuation. Products with stable demand are identified and assigned to a fixed repetitive-production cycle. Once this cycle is stabilized, it may be possible to shorten it. For all food-and-beverage SKUs, minimum and maximum boundaries of stocks are set in accordance with lead-time, variability of demand, and targeted service level. By increasing production frequency and thereby reducing lead-time, safety stock levels can be decreased.

The reduction of both the minimum and maximum boundaries of stocks decreases the average time that each product is held in stock, resulting in smaller inventories and fresher products going to customers. In addition, analyzing the accuracy of safety stock calculations and sales forecasting can further decrease required safety stock and lower inventories.

Responsibility for minimum and maximum boundaries of stocks is not generally in the hands of plant managers, so it’s important to involve the responsible departments. This is a good example of how a lean approach can eliminate silolike behavior and create shifts in culture.

The Green Side of Lean. Lean efforts in food and beverages can yield significant environmental benefits. OEE enhancements reduce energy consumption, which means lower carbon emissions, especially in countries where fossil-fuel-burning power generation dominates. Lower inventories can produce savings in refrigeration. Material loss optimization can mean reduced use of raw materials. Carbon footprint reductions of several percentage points can be obtained through a lean approach—at no incremental cost.

The Four Phases of Lean

The lean approach is divided into four basic phases: diagnosis, rollout, implementation, and sustained continuous improvement. Through all those phases, successful programs follow a number of key rules. (See the sidebar “Ensuring the Success of Every ‘Lean’ Project.”)
**Diagnosis.** The diagnosis phase lasts from 6 to 12 weeks and is designed to assess existing lean culture and abilities, set program objectives linked to company strategy, identify potential targets, and win top management’s support.

**Rollout.** This approach is based on enabling a company to take over full responsibility for the program quickly. A pilot lean effort follows the diagnosis phase, which begins with six to eight transformation kick-start workshops that last from three to five weeks.

Because it is important to generate momentum, a plant that has a greater-than-proportionate share of the addressable cost base is chosen for the first kick-start workshop. It is also helpful to choose a plant in which some employees have already received lean training and have lean tools. The first round of kick-start workshops should always include plants that manufacture the company’s main product. Fast and large financial wins help sell the concept to the rest of the organization.

For each kick-start workshop, a lean-program expert leads a team of six to eight shared lean experts from external plants and six to eight local champions. A workshop has six main phases: kickoff and hypothesis generation, training, observation of the current state, definition of the future state, calculation of savings, and implementation.

On the first day of a kick-start workshop, a plant tour of all processes is conducted and the main focus of the effort is identified. During the first week, the training focuses on lean methodologies, including how to perform analyses. After each training session, participants discuss their shop-floor observations.

The second week ends with an analysis of the current state of each chosen topic. Kaizen workshops, grounded in observation and visualization, are used to identify optimization potential and reach agreement on target future states. These discussions are rooted in the belief that anything is possible. The question asked is not, can it be done? Rather, participants ask, what would it take?

At the same time, the local champions direct the calculation of potential savings from all proposals. Throughout the program, participants learn to connect all contemplated process improvements directly to specific savings. Not only does this reinforce the key idea—saving money—behind the whole effort, it also helps structure implementation.

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**Ensuring the Success of Every “Lean” Project**

- **Adhere to a Structured Approach.** An hour-by-hour, round-the-clock agenda is a critical aspect of every effort.
- **Limit Capital Expenditures.** Solutions should involve existing equipment and personnel.
- **Achieve Maximum Financial Impact.** An essential goal is to cut the cost of goods sold by 2 to 3 percent and to free up net working capital by reducing inventories.
- **Create Sustainable Results.** A well-executed project is one that meets, exceeds, and can sustain its objectives.
- **Enable the Organization.** A typical program trains hundreds of employees to focus on continuous improvement.
- **Ensure a High Return on Investment.** The company should recoup the consulting costs within a few months of the rollout of the project.

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**BCG designs each lean-manufacturing initiative to conform to the following ten imperatives.**

**Move Quickly.** For each plant, identify savings, achieve the first quick wins, and train a critical mass of internal lean experts within three to four weeks.

**Tailor Each Project.** Build on existing efforts, adapting to the company’s specific needs.

**Focus on Every Aspect.** Working with about 20 employees in each plant, conduct due diligence. Leave no stone unturned.

**Improve Products.** A successful effort means fresher, tastier products, using less inventory.
The implementation plan describes the initiatives, shows potential savings, lists identified prerequisites, and maps major milestones.

Each lean-transformation kick-start workshop ends with a final readout, in which all proposals are presented to local plant management and invited top management. Reinforcing a sense of local ownership of the proposals, the local plant team, supported by the external team, presents the final readout.

The goal is for the program rollout to be self-sustaining after six to eight workshops. A one-week handoff workshop helps prepare the internal team to take over full responsibility for the lean program. In this workshop, the assigned lean-program experts, manufacturing top management, and the trainers agree on a schedule for continued rollout. Final training is offered on how to manage the program independently and maintain momentum.

**Implementation.** After the workshop, the local plant management takes over full responsibility for implementation under the supervision of the lean-program experts. The implementation process is driven by local champions who use workshops and Kaizen events to spread the knowledge—as well as the lean way of thinking—throughout the plant. The responsible lean-program expert revisits the plant for one full week every six to eight weeks after completion of the transformation kick-start workshop. Additionally, identified opportunities are tracked and reported centrally to help keep the attention and support of senior management. In recent case experience, BCG has found that many initiatives are implemented very quickly and the lean effort is actually self-funded within the first three months.

**Sustained Continuous Improvement.** Generating continuous improvement and, thus, competitive advantage requires four key elements. First, top management must do more than pay lip service to lean; the management team must be fully committed to lean transformation as a strategic objective for the company. Second, lean must be embedded in the company’s organization structure through designated lean-manufacturing officers and groups with real authority. Third, manufacturing performance must be carefully and systematically monitored using appropriate metrics. Finally, the company’s people at all levels must be continuously and actively engaged in the process. That means not only teaching lean techniques but also showing the value of lean to team members and other individuals. It also means providing them with strong incentives to contribute to the process of transformation.

**Freeing Capacity by Freeing Intelligence**

For all of its industry-specific details, an effective lean approach to food and beverage manufacturing is based on a simple idea: in most cases, the information needed to eliminate waste is already present in the plant. It is in the heads and the experience of the people who work there. The lean process is ultimately about eliminating waste by accelerating the flow of good ideas and decisions within a plant and an organization. It is about freeing capacity by freeing intelligence.

After his company embarked on a BCG-led lean-transformation effort, the COO of the supplier mentioned at the beginning of this report said, “The technical knowledge and awareness of the issues are typically with us anyway. This approach helped us really take up inefficiencies in a professional and systematic manner and solve them faster.”
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Acknowledgments

The authors would like to thank the executives and lean managers who shared their time and insight and gave feedback for this report. Furthermore, we thank the following people for their excellent insight and discussions: Ian Colotla, François Dalens, Adam Farber, Thomas Frost, Kai Oberschmidt, and Daniel Spindelndreier, as well as all the associated members of BCG’s lean advantage topic area, for providing us with helpful data, information, and feedback.

The authors would also like to thank Katherine Andrews, Gary Callahan, Peter Carbonara, Martha Craumer, Elyse Friedman, Kim Friedman, and Simon Targett for their editorial and production assistance.

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