Developing a Business Case for Integrating Manufacturing and Supply Chain

How Operational Excellence programs help optimize inventory and protect product margins

Introduction

Today's consumer products manufacturers face intense global competition for market share and profitability. They must operate in a climate of volatile costs, shrinking profit margins, and constantly changing buyer preferences. Manufacturers must significantly improve their agility and compress their cycle times to compete in this dynamic, uncertain environment.

Whether it's global financial uncertainty, fluctuations in ingredients, packaging and logistics costs, or the changing buying habits of consumers year over year, external factors are becoming increasingly complex. Many of these challenges are outside the control of the manufacturers themselves, requiring internal improvements that drive efficiencies within production processes.

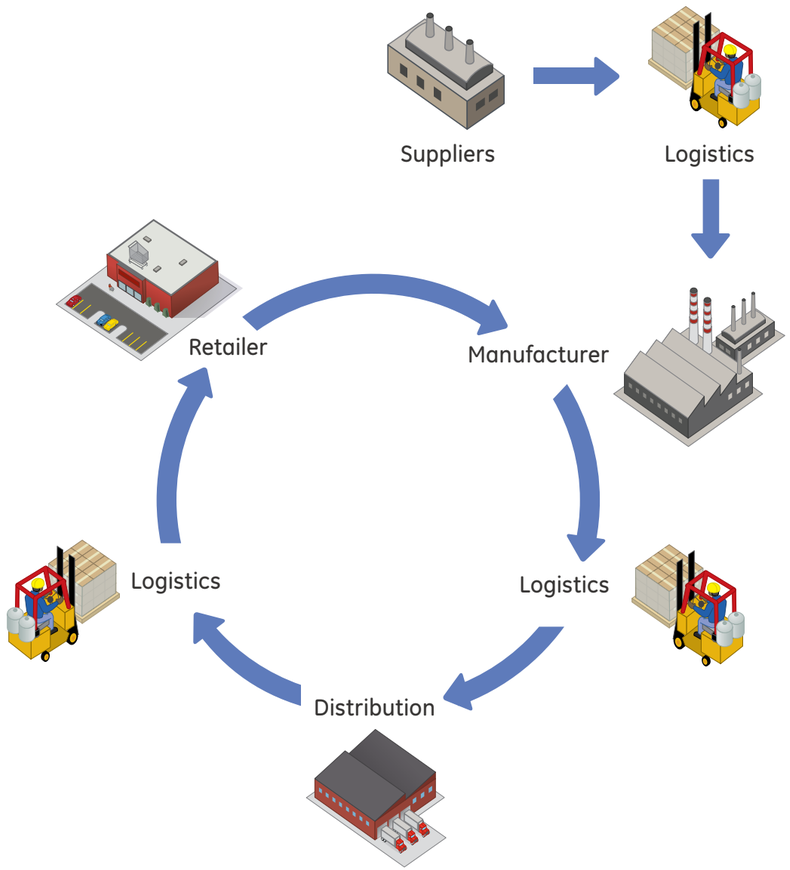
Extending manufacturing Operational Excellence programs into the supply chain helps optimize production and planning. Real-time production data allows manufacturers to understand what happened, what is happening, and what might happen next, significantly increasing the agility of a manufacturer's supply network.

This paper will explore the strategy of integrating manufacturing and supply chain and provide guidance on how to develop a business case to justify this approach. Highlighting a consumer packaged goods (CPG) manufacturer as a specific example, it will cover the potentially significant financial and operational impacts of supply chain integration. While many companies define their key performance metrics differently, the general principles are universal and can be aligned to meet specific organizational initiatives.

Increasingly complex external factors require consumer manufacturers to take a closer internal look at capturing efficiencies within production processes, which can deliver significant advantages.

Uncertainty is the new norm

External factors are not predictable, and even slight changes impact a manufacturer's bottom line.



For example, rising costs affect a global CPG manufacturer based in Germany that produces household cleaning products. Its primary cleaning product has a blend of chemicals made on site through a batch process. The product is then packaged into plastic containers and shipped via the manufacturer's in-house logistics group which, in turn, distributes the product to the manufacturer's warehouses.

Though the company has end-to-end control over production processes inside its four walls, it has no control of the external fluctuations that impact the profit margins of its core product.

In this example, consider four of the largest costs in the manufacture and distribution of its products:

- Electricity for the chemical batch process
- Water as an ingredient of the product
- Cost of the PET (Polyethylene Terephthalate) plastic bottles
- Fuel to ship the product to the warehouse

The external price impact on margins between 2012 and 2015 is as follows:

Table A	2012	2015
Energy cost (140hr batch cycle to 690f—energy used 3,177kwh) Source: Eurostat (online data code: nrg_pc_205)	€0.1423 per kwh = €452 per batch	€0.1496 per kwh = €475 per batch
Pet prices (1 batch = 50,000 bottles) source: plastixx—pie polymer price index	€1,290 per metric ton = €645 per batch	€1,320 per metric ton = €1,225 per batch
Water prices (110 cubic meter batch requires 82.5 cubic meters of water) source: federal environment ministry & global water intelligence *2014	€2.03 per cubic meter = €167 per batch	€4.4 per cubic meter* = €363 per batch
Diesel prices (average delivery 200 km at 10km/liter) Source: gasoline-germany.com	€1.41 per liter = €28 per delivery	€1.27 per liter = €25 per delivery
Total	**€1,293**	**€2,089**

Weathering the storm

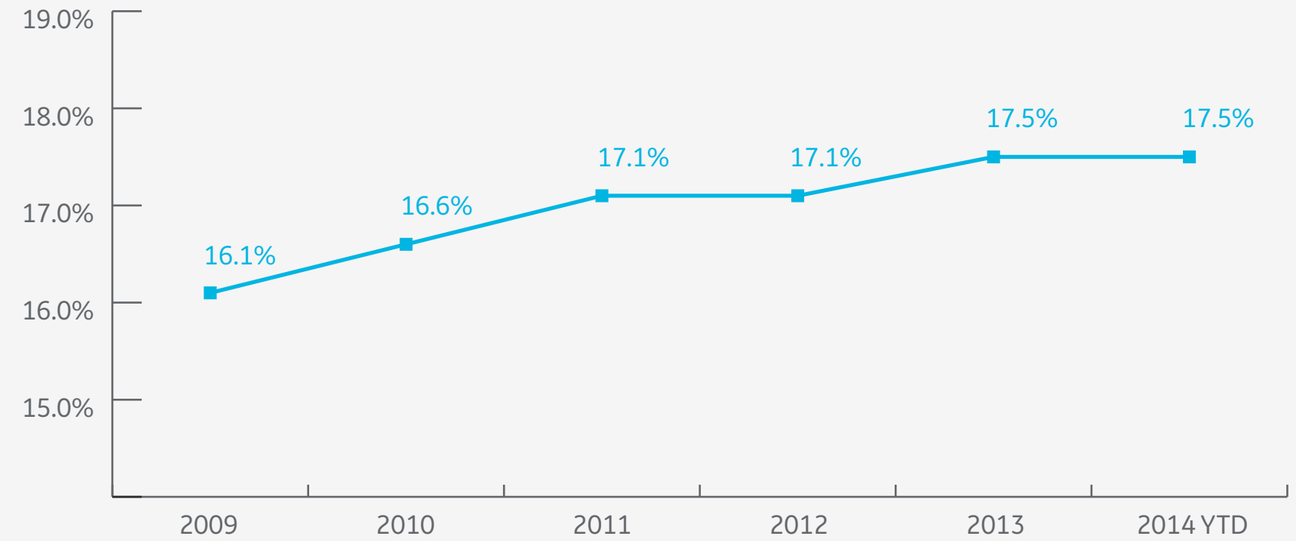
How should the manufacturer react to the uncontrollable forces affecting its profit margins? Initially it could try and pass some of the price increase onto consumers. But in the current economic climate, that is very risky, as shown recently by one global consumer company, P&G, which experienced a 1% decline in global market share after imposing a 5% price increase on its fabric home care products. P&G has since recovered, but the example illustrates that a small price increase can have a significant impact on market share—even for market leaders.

Another potential side effect of passing the cost onto consumers is driving them to seek alternative brands and private-label products. For example, market data shows that once consumers switch from a name brand to private-label in the consumer packaged goods industry, they rarely switch back.

The risk for brand-label manufacturers, is that once a customer is lost to a private label brand, they are more likely lost for good. This is backed by data that shows the continued growth of private-label products over the past few years.

This risk is not just applicable to CPG companies. A recent Business Week outlook reported, “By 2025, one in every three food product purchases in the U.S. will be a private-label product.” Furthermore, the risk of losing customers as a result of passing costs onto them applies to both brand-label and private-label manufacturers, as consumer switching costs and product differentiation decline.

PRIVATE-LABEL DOLLAR SHARE (UNITED STATES)



Source: "The State of Private-Label around the World" November 2014, Neilsen N.V.

Operational Excellence journey

A strategy that focuses on the factors manufacturers do control—specifically, the manufacturing assets within the four walls of the factory—can yield significant margin stability. For example, working with many global consumer manufacturing companies, GE Digital has developed the Operational Excellence journey, a strategic framework to drive manufacturing process agility and repeatability. Powered by the Industrial Internet, it delivers a tactical step-by-step approach to help manufacturers connect their systems, gain insights, and optimize their data.

Connected: Machines and data for an integrated view of one's entire operations, across the enterprise.

Learn: Using advanced real-time data analytics to understand what drives factors such as OEE, equipment downtime, waste, production quantity, inventory, and more.

Optimized: Operations, maintenance planning, and equipment reliability through predictive analytics and resulting actions.

Leveraging GE Digital's Operational Excellence journey, many F&B and CPG companies have driven significant productivity improvements such as:

- 4% lower material costs
- 15% lower logistics costs
- 20% decreased rework
- 30% faster new product launches
- 30% reduced inventory
- 12% reduced energy consumption

As the Operational Excellence journey evolves, each step enables the manufacturing process to become more predictable and repeatable, a key factor in being able to maximize savings in the supply chain.

GE Digital's Operational Excellence framework is designed to help maximize the profitability of existing assets, starting with visibility into process data and insights and culminating with the integration of manufacturing data into the supply chain for significant financial benefits.

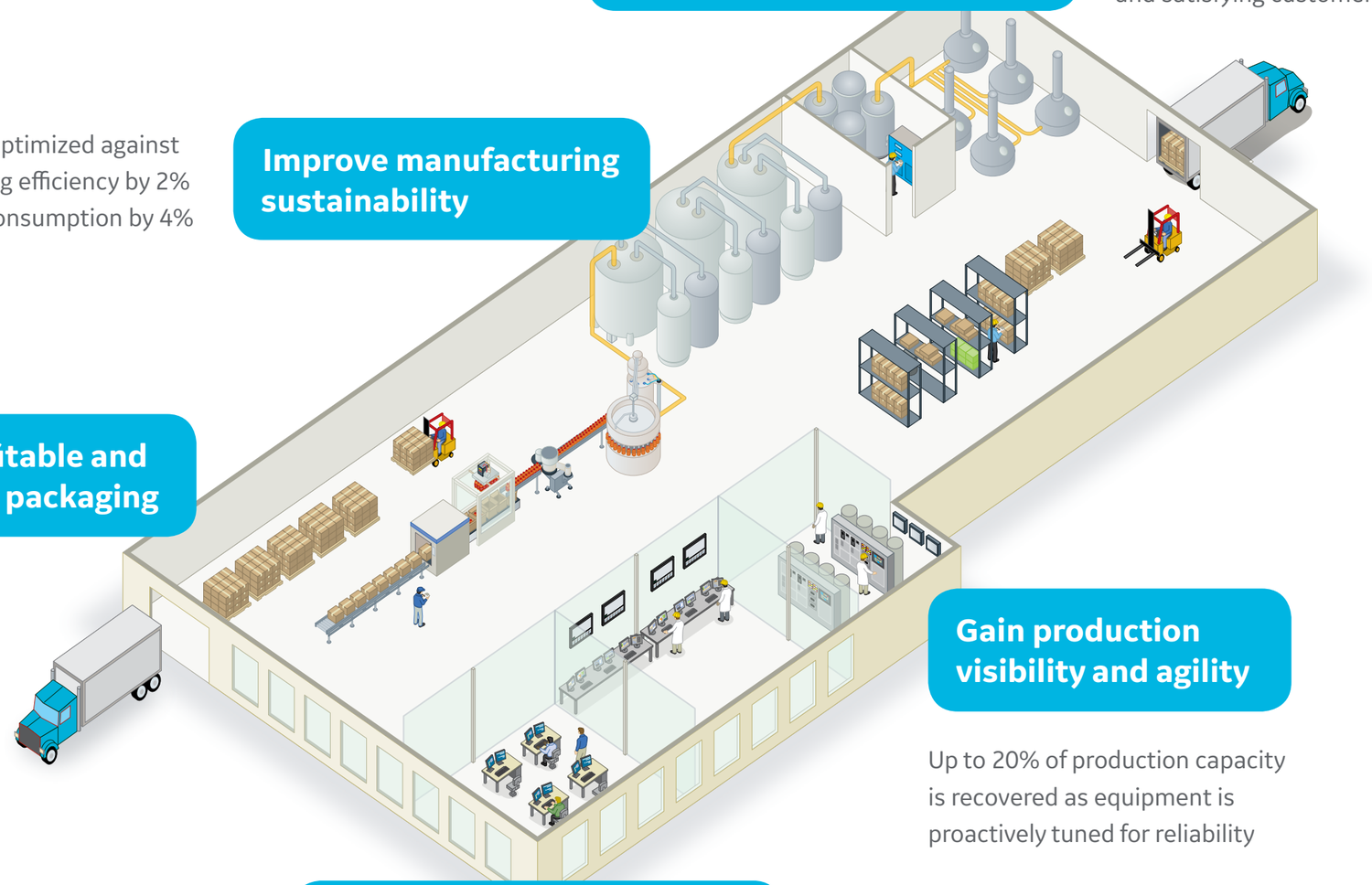
Typical process improvements

Minimize raw material costs and protect brand quality

Comprehensive quality data can be shipped alongside product, reducing rework by 20% and satisfying customer traceability needs

Improve manufacturing sustainability

Utility infrastructure is optimized against process needs, improving efficiency by 2% and lowering material consumption by 4%



Enable profitable and sustainable packaging

Reliable, predictable production capacity allows finished goods buffers to be reduced 30% or more

Gain production visibility and agility

Up to 20% of production capacity is recovered as equipment is proactively tuned for reliability

Optimize scheduling and operator productivity

The link between productivity improvements and profitability

The previous figures highlight productivity improvements, but how do those improvements translate into actual revenue? Going back to the example of the global CPG manufacturer in Germany, assume it has started its Operational Excellence journey. Using conservative estimates, the following production savings can be achieved:

5% decrease in batch cycle time
10% improvement in machine reliability
10% reduction in water consumption
5% reduction in energy costs

The internal savings impact on margins is as follows:

Table B	2015	Cost savings after productivity improvement
Energy cost (140hr batch cycle to 690F—energy used 3,177kWh) Source: Eurostat (online data code: nrg_pc_205)	€0.1496 per kWh = €475 per batch	Cycle time optimized by 5% (5% recovered capacity) 133hr = 3018kWh x €0.1496 per kWh = €451 per batch **€24 savings per batch or 5% cost savings**
PET prices (1 batch = 50,000 bottles) Source: Plastixx—PIE Polymer Price Index	€1,320 per metric ton = €1,225 per batch	5,000 bottles recovered waste 10% 5,000 bottles = **€123 savings per batch**
Water prices (110 cubic meter batch requires 82.5 cubic meters of water) Source: Federal Environment Ministry & Global Water Intelligence *2014	€4.4 per cubic meter* = €363 per batch	Reduce losses by 10% 10% of 82.5 cubic meters = 8.25 cubic meters = €327 per batch = **€36 savings per batch**
Total savings per batch		**€183**
Total annual savings (based on one batch per week for 52 weeks)		**€9,516**

An annual savings of €9,516, as shown in Table B, equates to a 9% increase in profitability. It does not offset all the external price increases but is a step in the right direction and drives toward the key capability to interface with the supply chain. It's critical when building the business case to have a good understanding of the increased profitability to justify the investment. To keep things simple, this example is just for one single batch in a plant that makes multiple batches on multiple lines.

For perspective of how these benefits scale across both a plant and organization, take the findings of two real consumer products manufacturers. They have both focused on the ability to gain insights to improve the reliability of their machines by using Overall Equipment Effectiveness (OEE) as a continuous improvement metric.

OEE measures the theoretical maximum throughput and quality against the actual performance of an asset by stock keeping unit (SKU).

One of the companies, a global brewer, discovered that one point of OEE improvement in packaging across its organization was worth €2.4 MM annually. Similarly, the other company, a global tissue manufacturer, determined that one point of OEE improvement on the tissue machine was worth €2 MM annually. To emphasize, that was per machine. These levels of production savings are compelling, and they help to justify the integration of manufacturing with the supply chain.

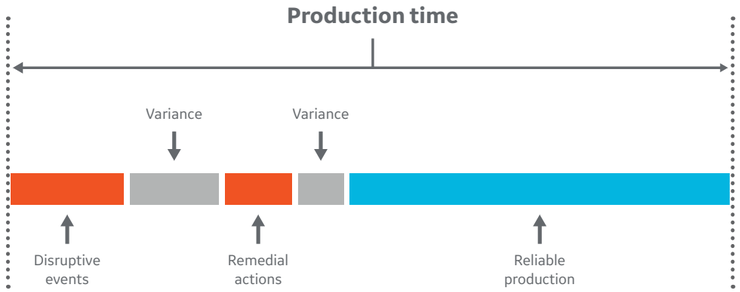
Manufacturing's role in the supply chain

While integrating manufacturing processes into the supply chain, some challenges around the variations in supply chain effectiveness can stem from different components. Historically, manufacturing has shown to be one of the least stable supply chain integration variables. The "lumpiness" associated with manufacturing is sometimes called a "bullwhip" effect, and is a key component of the ebb and flow of the supply chain.

THE BULLWHIP EFFECT

Source: Ekaterina Startseva, Lappeenranta University

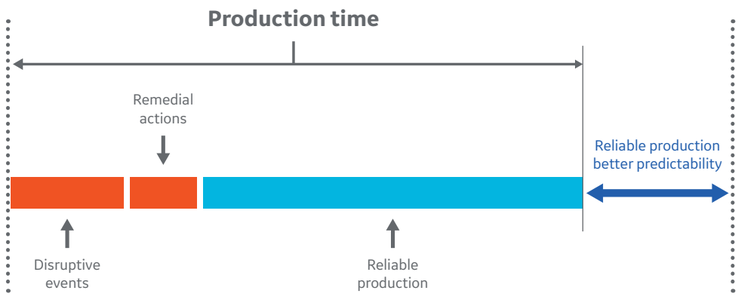
So when analyzing the manufacturing process, how do these variations occur?



As shown in the chart above, every time there is a disruptive production event, remedial actions must occur. The less predictable the events, and the greater the associated remedial effort, the larger the variance in production time—one of the key reasons the "bullwhip" effect occurs.

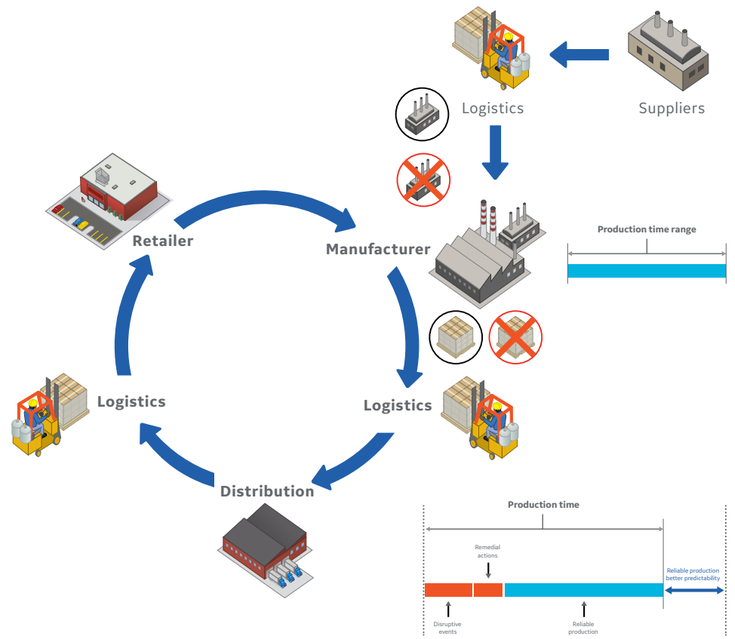
To ensure the right products are available on the shelf at the right time for consumers, companies endeavor to smooth out the variance by holding large amounts of raw ingredients and finished goods inventory. However, arbitrarily elevated inventories do not fix the problem; instead, they mask the problem.

The step-by-step implementation of the Operational Excellence journey delivers a more predictable process by optimizing asset reliability and improving remedial processes. After implementing the Operational Excellence journey. a representative production timeline looks more like this:



A manufacturer cannot remove all disruptive events, but it can reduce them and better resolve the problems, minimizing the overall impact on production time. Once the underlying problems have been addressed, raw material and finished goods inventory levels can be optimized and response times compressed.

Impact of reliability on supply chain



So, what is the actual gain as far as profitability to the bottom line? Exploring further, a manufacturer needs to consider this question: "How much does it cost to hold inventory?"

This will differ from company to company based on product mix, but the base formula will be the same, and only the percentages will change. On the following page, the variable ranges are listed to help tailor the formula.

Cost of inventory

While holding costs are company specific, here are some industry examples:

Holding costs	=	**capital + inventory service + storage space + risks**
Capital	=	inventory investment
Inventory service	=	insurance + handling + taxes
Storage space	=	plant warehouse + public warehouse + rented warehouse + refrigeration costs
Risks	=	obsolescence + damage + shrinkage + relocation costs

inventory investment	(2% - 6%)
insurance	(1% - 3%)
handling	(2% - 5%)
taxes	(2% - 6%)
company warehouse	(1% - 2%)
third-party warehouse	(2% - 5%)
obsolescence	(3% - 8%)
damage and shrinkage	(3% - 6%)
relocation costs	(2% - 5%)

Example cost of holding inventory based on the examples:

Capital	=	4%
Inventory service	=	1% + 2% + 2%
Storage space	=	2%
Risks	=	3% + 3% + 3%
Yearly holding costs	=	4% + 5% + 2% + 9%
	=	**20% of inventory value**

To put that into perspective, €1 million in inventory costs = €200,000 to hold.

The Operational Excellence Journey improves predictability and allows inventory to be optimized based on production improvements. The following example illustrates the impact:

Current state

60 days inventory = €60 million
Yearly holding costs = 20% = €12 million

Future state with improved process reliability

40 days inventory = €40 million
Yearly holding costs = 20% = €8 million

30% Inventory reduction = €4 million savings annually

In addition, there would also be the one-off cash benefit of liquidating excess inventory—€20MM in this example. Another value the Operational Excellence journey offers, once stock levels are optimized, is the offsetting of potential indirect / overhead costs when production is forced to slow down due to decreased demand for inventory replenishment. Furthermore, additional cost savings can be captured by renegotiating logistics contracts, as the need for expedited deliveries is reduced.

Returning back to the CPG manufacturer example, which has now "stabilized" the production process with savings in cycle time, OEE, energy, and material consumption, the increased value of integrating the supply chain is as follows:

It makes four batches of product a month, and the cost to manufacture per batch (including materials, direct, indirect, and overhead) is €100K per batch = An Inventory value of €1.2 MM for 12 batches in 60 days:

Holding stock	=	60 days
Inventory value	=	€1.2 MM
20% holding costs	=	€240,000

Assume 20% inventory reduction due to reliability improvements:

Holding stock	=	48 days
Inventory value	=	€960,000
Holding costs	=	€192,000

Annual savings (including Operational Excellence production savings from Table B): €48,000 + €9,516 = **€57,516**

As shown, the annual Inventory savings for this one line (**€48,000**) are more than five times larger than the annual productivity savings (**€9,516**) of the production process itself. But it could not be achieved without the production process improvements to reduce the "bullwhip" effect.

Building the business case

Taking into account all that has been covered, what key elements do manufacturers need to use as part of a business case for integrating manufacturing into the supply chain?

01 Understand your own company's current strategic focus areas

Do you have specific targets around continuous improvement, material yield, margin increase, and inventory cost reductions that can be aligned with your business case? Success requires sponsorship in the organization, and rallying around these cross-business goals will support ownership—and associated funding—to turn the business case into a business plan.

As you develop your case, engage with key stakeholders early to understand approvals or objections. The mission statement needs to tie it back to the business case, and you need some high-level supporting data from the following steps to support and validate your case.

02 Understand the value of stabilizing the manufacturing process

As discussed earlier, one of the key metrics used to drive continuous improvement is Overall Equipment Effectiveness (OEE). This metric takes into account the ability to produce over what is actually being produced. It is critical to quantify the cost of lost production due to unplanned downtime and the cost to ramp additional production. This data will enable you to construct a comprehensive business case. The data itself will come from a mix of input from both the production managers and Finance.

03 Work with Finance and Logistics to quantify the essential holding costs for inventory

Manufacturers need the answer to "What does it cost us to hold inventory for one day?" You then need to understand the turnover times of stock to calculate the current buffers in place to offset the manufacturing bullwhip effect. Consider how potential improvements in the manufacturing process could reduce inventory.

Again, develop quantifiable improvement goals with key stakeholders in this area. Some manufacturers have created manufacturing "scorecards" that examine their production and incorporate these key performance indicators; it's an effective way of looking at cross-business impact, and it is a recommended best practice.

04 Develop your business case and break it down into manageable chunks

Use your Operational Excellence journey to incrementally drive continuous improvement tactics across manufacturing and then into the supply chain, where they are aligned with the quantifiable goals generated from the prior steps. Leverage relationships with industry experts to help refine and validate your business case.

05 Finally, present your case

If it's aligned with current strategic business goals, you already have buy-in from key stakeholders. Further, your due diligence on the numbers will allow you to convert your business case to a business plan.

The business case should help you focus on the specific steps of the journey–enabling you to yield the greatest value. As your Operational Excellence journey progresses and results materialize, you can use the data to validate your forecasts and drive additional steps in the future.

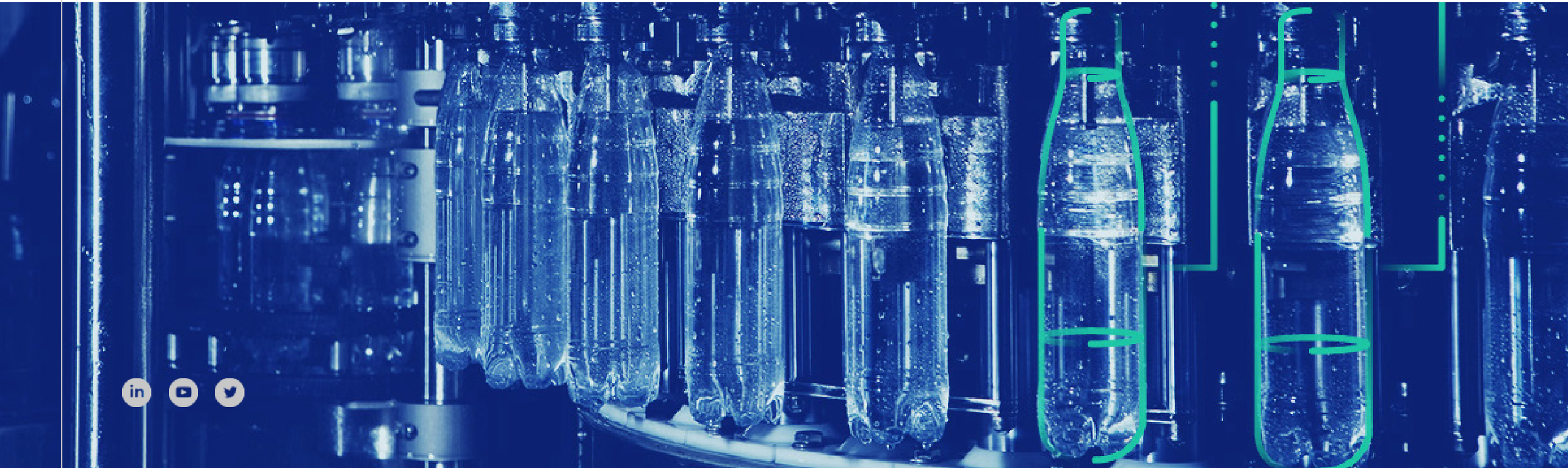
Summary

Consumer products manufacturers are under increasing pressure to maintain margins and reduce cycle times in a climate of increasing uncertainty. Since external factors, such as rising energy costs, are beyond an organization's control, manufacturing leaders must improve controllable processes to reduce costs, improve agility, and drive competitive advantage. Initiatives aimed at improving productivity, reducing inventory carrying costs, and integrating manufacturing with the supply chain offer significant optimization opportunities.

To achieve success, manufacturing leaders can leverage GE Digital's Operational Excellence journey framework to accelerate the development of comprehensive business cases. The approach starts with helping you connect your systems and combines proven, quantifiable practices that build upon each other and incorporate the inputs of key stakeholders to move you forward to gain insights and optimize your data.

Success requires the ability to justify the approach of extending manufacturing Operational Excellence programs into the supply chain. Developing a solid business case, backed by figures that reflect the financial impact is key to building the critical support and buy-in needed from stakeholders. Once the goals and expectations are defined, manufacturers can leverage a strategic framework like the Operational Excellence journey to drive productivity improvements.

While the Operational Excellence journey requires effort, the results are compelling, particularly when manufacturers can incrementally drive toward supply chain agility. From an improved manufacturing productivity perspective, the value add comes when the incremental wins drive the next step of continuous improvements. A more predictable process reduces the impact of variation in the supply chain which, in turn, enables manufacturers to optimize their inventory and stabilize profit margins—driving optimized business performance.



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