Supply Chain Brief: Deliver Efficient “Manufacturing Perfect Orders” to Optimize Supply Chain Cost

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By Analysts Paul Lord, Simon Jacobson, Michael Dominy

Initiatives: Manufacturing Operations Strategy and Performance

While asset productivity is not sufficient for supply chain cost optimization, reliable supply from efficient operations is essential. This research provides manufacturing operations leaders with a basis for driving “manufacturing perfect orders” to enable optimized network performance.

What You Need to Know

The strategic decision to invest in manufacturing assets comes with risks and obligations that impact the entire organization. Excessive pressure to reduce operating cost within manufacturing can undermine the operational excellence principles that serve to maximize value from asset investments. Moreover, a lack of reliable product supply from manufacturing makes it impossible to deliver an efficient response to demand that optimizes performance with the right degree of agility and resilience.

As an alternative to leadership messaging about “asset productivity” or “cost reduction,” desired supply network performance can be supported through consistent focus on the delivery of efficient manufacturing perfect orders (see Note 1). The manufacturing perfect order (MPO) measures and confirms that all quality, compliance and timing requirements for product availability into the network, channel or customer location are sufficient to fulfill demand. This aligns site-level performance with the synchronization of networkwide operations performance to achieve the profitable perfect order.

Analysis
For product-centric companies in the consumer, industrial, high-tech and life science sectors, the choice to invest in manufacturing capacity is a strategic business decision that brings operating, maintenance and other responsibilities. This may be driven by the need to develop and protect proprietary product and process technology from competitors. Alternatively, companies may conclude that they can achieve meaningful performance advantages (including reduced risk, lower cost or more agility and resilience) by investing to own and operate an integrated manufacturing network compared to the available options for outsourced contract manufacturing.

Reliable Manufacturing Is Essential for Optimized Network Performance

Optimized network performance requires acceptable levels for both cost and service. This cannot be realized (or even pursued) without acceptable manufacturing reliability. Supply failures (whether in volume, quality or timing) drive schedule changes, rework, expediting and complex allocation plans with late or partial deliveries. Supply chain planners are often compelled to carry additional inventory or develop secondary outsourced manufacturing options as a hedge against chronic reliability and quality issues. Management attention and valuable resources are consumed in corrective actions to meet minimum performance levels, particularly in reliability gaps that also jeopardize safety or compliance.

For these reasons, leading organizations place top priority on the foundational elements of manufacturing performance. Not only do shortfalls undermine service performance from the network, but they have significant financial impacts as illustrated by these figures:
Gartner’s Cost of Quality Benchmark Survey found that while companies spend in the range of 1% of revenue on quality prevention and assurance, they also incur an average of 4.2% of revenue in costs due to poor quality (see Cost of Quality 2019 Benchmark Report).

The cost of emergency repairs for broken equipment is three to five times higher than for the same repairs during planned maintenance. Analysis has further estimated the total financial impact of a shutdown between four to 15 times the cost of repair. These impacts can include the cost of loss capacity in addition to detrimental impacts on safety, compliance and quality.¹ A lack of planned and preventive maintenance can also reduce the total life of an asset, which reduces the overall return on capital investment.

Fines for environmental compliance violations are incurred per day and per site. The level of regulatory oversight and severity of fines for violation varies around the world. A recent analysis of fine settlements in the United States found average daily rates ranging from $42,000 for emergency planning and community right-to-know violations to $122,100 for Clean Air Act violations.²

The cost of workplace safety extends well beyond medical costs, with lost time and other types of productivity impacts in 57% of 2018 incidents. Safety has been a primary performance focus within leading manufacturing organizations for the past several decades, resulting in a 47% reduction in the reportable incident rate since 2002.³ While the estimated financial impact of injuries in the industrial sector had fallen to $170.8 billion by 2018, the coronavirus pandemic of 2020 presented new challenges for ensuring worker health, with significant productivity impacts.

Improved planning, scheduling and execution control is important to maximize conversion and utilization efficiencies for labor, capacity, energy and raw materials. But the incremental cash impacts of those operating efficiencies may be modest and are often overwhelmed by the significant financial and business impacts of failures in reliable, quality product supply to the network. Despite common perceptions that poor maintenance practices are the primary source of production capacity losses, studies have found that scheduling, operating and purchasing practices contribute significantly to reliability failures.⁴ The economics of every situation are different, and the relative impacts and priority of efficiency versus reliability must be balanced and prioritized.

More Asset Productivity Is Not Always a Path to Cost-Optimized Supply

Asset productivity is one benefit of improved reliability, resulting from fewer unplanned outages and reduced rework to correct quality problems. If sustained over time, this will contribute positively to return on capital investment. However, problems may arise when local productivity within manufacturing (or any other function) becomes an operating key performance indicator (KPI). Consider the following:

- Goals to “sweat the assets” (often intended to create stretch goals for operations) result in unrealistic production plans due to a lack of rough-cut capacity planning that allows for normal delays in quality testing and changeovers. Any significant levels of unplanned downtime create prolonged supply delays. Over time, supply plans become viewed as unreliable due to a persistent lack of feasibility.
The cost structure for manufacturing includes a high proportion of sunk capital and associated fixed costs that cannot be reduced or avoided. A singular focus on asset productivity for cost absorption contributes to oversupply that occupies cash and increases inventory risk (see Supply Chain Leaders Must Neutralize the Forces of Oversupply to Control and Optimize Inventory).

Opportunities to enhance asset productivity must be weighed against other impacts beyond the manufacturing site. In addition to inventory considerations, network transportation and warehousing costs are significant, with total values ranging from 3% to 7% of revenue. This can include the potential for significant inefficiencies in material handling and product distribution if manufacturing performance does not match network demand.

Aligned, reliable manufacturing performance allows supply chain to focus on its primary mission — the effective fulfillment of demand. Cost is just one aggregated measure of performance based on an accounting valuation of diverse resources consumed or occupied across the network.

The constraints, interdependencies, uncertainties and competing forces across the supply network and organization make consideration of trade-offs an overly simplistic approach to complex decision making. Gartner describes strategic cost optimization as the result of a comprehensive design approach to improvement based upon alignment around clear performance requirements for network operating outcomes that fulfill demand (see Focus on Operating Outcomes, Not Reduction Targets, to Optimize Supply Chain Cost). The research features numerous examples in which comprehensive end-to-end alignment and upgraded capabilities delivered improvements that did not require direct trade-offs between cost, service, quality or inventory.

The three distinct outcomes that must be defined, delivered, measured and improved to approach optimization of product and supply chain cost are as follows:

- **Effective service delivery and demand fulfillment.** This is the primary operating outcome supported by supply chain cost, particularly direct freight to the point of delivery. The conditions for this outcome must be clearly defined and differentiated by channel or demand segment, where appropriate, in order to optimize the cost of fulfillment.

- **Reliable, cost-optimized product supply.** This outcome supports the fulfillment of demand and is enabled by effective supply and inventory planning to synchronize materials and capacity required for the production, assembly, testing and packaging of finished goods. Raw material freight costs might be incurred separately if inbound deliveries are managed directly.

- **Risk-optimized growth events,** such as new product launch, network expansion and new project or contract bids. These outcomes involve different trade-offs and decision making in which the risk of
Network performance attributes (such as agility and resilience), operating constraints and a significant portion of total costs (including those associated with internal manufacturing assets) will be determined by design choices. These include management of the product portfolio, commitment to customer service levels, selection and negotiations with suppliers, and configuration of the manufacturing and distribution network.

Pressure for immediate actions that improve cost do not reduce expectations for reliable supply that meets service-level commitments. While effective individual processes and functions are important, improvement requires monitoring and root cause analysis across the full scope of a supply network. Operations leaders must adopt a systemic approach to measuring, analyzing and reducing waste across the network rather than within isolated locations or narrow functional scopes. Inefficiencies within one location or function may be the result of conditions or decisions made elsewhere in the factory, supply network and organization. For example, frequent production schedule changes often reflect rush orders that violate established minimum customer order lead times (see Video: From Logistics Efficiency to Strategic Cost Leadership at Bridgestone).

Achieving the right performance balance requires a combination of detailed measurement and integrated network planning (see Network Diagnostics and Planning Excellence Are at the Heart of Supply Chain Cost Optimization). Cost-optimized network planning balances local manufacturing productivity with the deliberate positioning of buffers or frequent operating changes. While these may detract from measured asset productivity, buffers support the necessary degree of network resilience to ensure supply. More frequent changes enable agility for an effective response to volatile and urgent demand (see Apply 4 Principles for Integrated Supply and Inventory Planning Capability). Arbitrary top-down targets, whether to drive capacity utilization upward or inventory levels down, create constraints to finding the right balance between assets and working capital for optimized network performance.

Synchronize Cost-Optimized Supply by Delivering Efficient Manufacturing Perfect Orders

Legacy measures of manufacturing performance, such as asset utilization and overall equipment effectiveness (OEE), describe the aggregated impacts of quality, reliability and efficiency losses (see Note 2). While asset utilization over time is ultimately driven by demand levels (which are not controlled by manufacturing), the underlying intent of OEE to measure and improve product quality, asset productivity and reliability has validity. However, OEE cultivates an internal focus that does not accommodate business strategy or connect directly to customer experience and successful product launch. For example, a goal to maximize OEE conflicts with the need for frequent changeovers to provide supply agility for complex product portfolios with dynamic demand. Planned capacity losses, which reduce OEE, cannot be measured and viewed as equivalent to other operating inefficiencies since they are intentional choices to bring inventory and service levels into balance with asset productivity.
These measurement ambiguities have been resolved by the concept of a manufacturing perfect order to provide more direct alignment between manufacturing incentives and supply network objectives (see Use the Hierarchy of Manufacturing Metrics to Connect Manufacturing and Supply Chain Performance). The MPO can be measured, analyzed and improved as the internal operating outcome that supports optimization of total product supply cost. Maximized asset productivity and operating efficiency can be pursued through better planning, scheduling and execution control within the constraint of meeting network requirements as measured by the MPO.

The efficient MPO takes on different attributes and performance expectations based on the nature of the demand signal, product characteristics and operating constraints. Consider the following two extremes:

- Asset-intensive process manufacturing in heavy industries (refining, petrochemicals, metals and paper) is highly constrained by low margins and expensive shutdown costs. Demand must be shaped, with inventory used as a buffer, to balance against these economic constraints and protect tighter margins. These assets are typically run in make-to-stock operations in which the MPO is defined by compliance to precise monthly production plans and weekly production schedules that have been cost-optimized to protect profitability, with sufficient capacity utilization levels.

- Complex portfolios of differentiated, high-value products (some of which are custom-configured for individual customers) require greater degrees of manufacturing agility (with less emphasis on asset productivity) enabled by capacity and raw material buffers (see Supply Chain Brief: Postponement Is More Than an Inventory Strategy). In the most extreme cases, the MPO will be equivalent to the customer-centric perfect order in which the sales order directly triggers a corresponding work order in the production schedule.

In each of the above cases, yield or capacity losses, excess labor costs, inventory obsolescence and other forms of inefficiency can be measured, analyzed to identify root cause and reduced where possible to maximize the efficiency of delivering the MPO.

Pursuit of a digital vision that includes smart factories to leverage new technologies does not change the objective, but creates the potential for increased levels of success and performance in delivering the efficient MPO for cost-optimized profitable growth (see Note 3). The underlying culture of operations excellence, driven by value-based behaviors and habits, remains essential (see 4 Tactics for CSCOs to Shift Manufacturing From a Cost of Doing Business to a Competitive Weapon).

Recommendations
Manufacturing leaders responsible for operations strategy and performance should:

- Create performance transparency by analyzing and communicating the impacts of manufacturing reliability, quality, safety and compliance on operating cost, supply network performance and asset life cycle investment value.
Solidify alignment by working with a broad set of stakeholders, including supply chain and finance partners, to define and emphasize efficient manufacturing perfect orders as a KPI that supports cost-optimized network performance and product supply.

Support efficient MPO delivery to the network by budgeting and protecting spending for the implementation of practices in operations and quality that include, but extend beyond, planned and predictive asset maintenance.

Evidence

1. The Real Cost of Unreliable Equipment — It’s Significant, Matthews Australasia.


4. Improving Availability is Much More Than Maintenance, Life Cycle Engineering.

5. This range is representative of average transportation and warehousing costs across manufacturing industries based on data collected within Gartner’s ongoing Supply Chain Hierarchy of Metrics Benchmark program and the 2020 Supply Chain Spend and Staffing Benchmarks survey.

Note 1: Manufacturing Perfect Order

Gartner defines the manufacturing perfect order as the contribution of manufacturing operations to the customer perfect order. It meets product specifications and other quality requirements, complies with all regulatory constraints and is provided for delivery into the network, channel or customer location on time.

Note 2: What is OEE?

Overall equipment effectiveness (OEE) is widely considered the gold standard for measuring manufacturing productivity. The OEE metric is based on three loss factors associated with lack of availability, quality failures and reduced performance (e.g., longer cycle times or reduced speed). Availability loss includes both unplanned stops (from equipment failure or material shortage) and planned stops (such as changeover time). An OEE score of 85% is considered world-class for discrete manufacturers, while scores near 60% are typical.

Note 3: Smart Factory

The smart factory refers to a vision for different combinations of modern technologies that synchronize processes, information and people to create a hyperflexible, self-adapting manufacturing capability. Smart factory initiatives might also be referred to as “digital factory” or “intelligent factory.”
Recommended by the Authors

Supply Chain Brief: Protect Operating Outcomes While Pursuing Short-Term Cost Reduction
The Hierarchy of Manufacturing Metrics: Frequently Asked Questions
Hype Cycle for Manufacturing Operations Strategy, 2020
Drivers of a Strong Culture of Quality
Mapping a Route to Asset Management and Reliability
6 Critical Changes That Affect the Future of Asset Maintenance
Research Roundup: Cost Optimization in Supply Chain

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