OPERATIONS METRICS FOR ACTION Guide

synchrono manufacturing software

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Metrics for Action

OPERATIONS METRICS FOR ACTION Guide

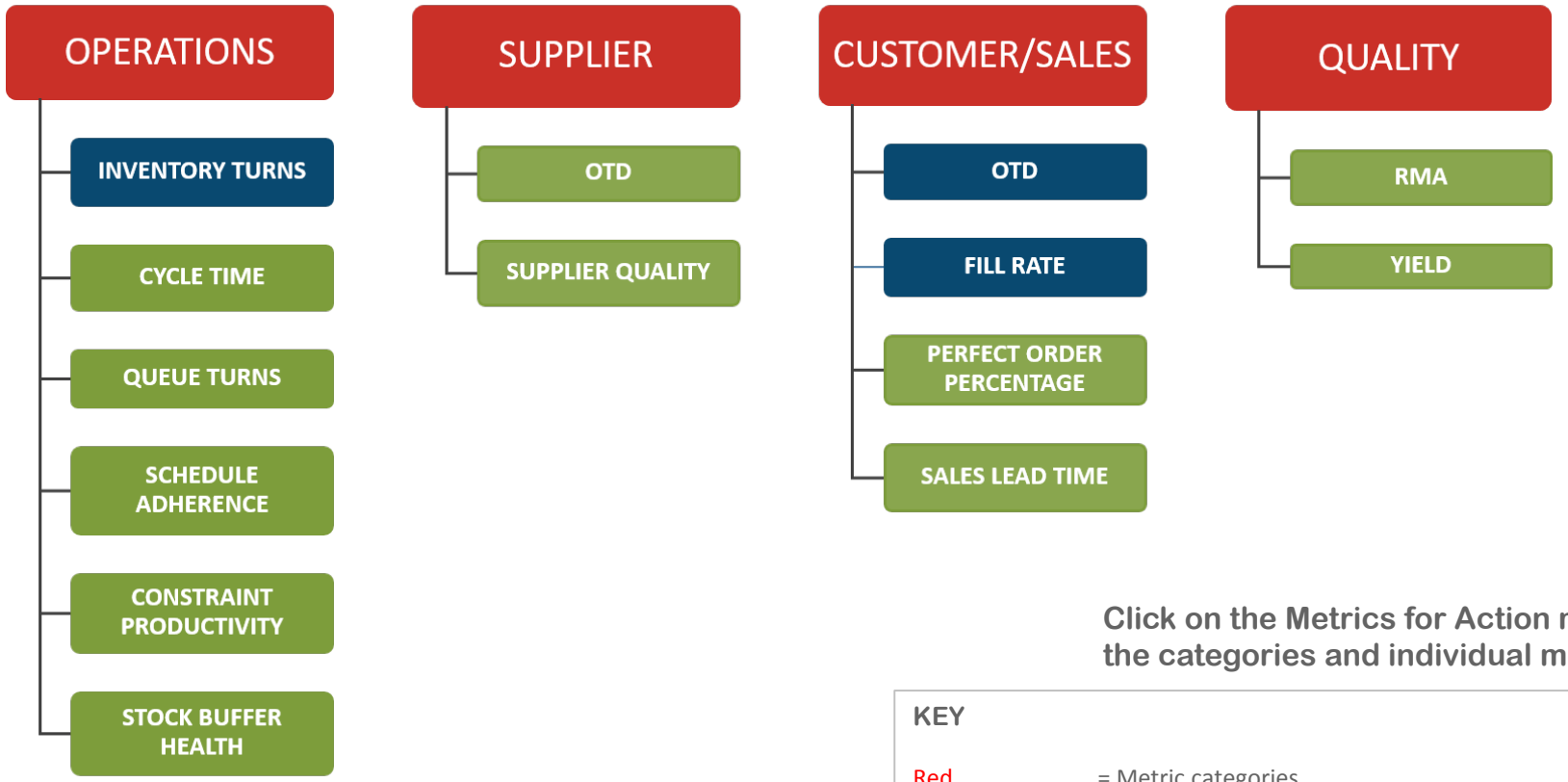
Metrics that drive action in Demand-Driven Manufacturing operations

When it comes to metrics that really matter in driving demand-driven operations, we think less is more. Less conflicting measurements, more focus on *actionable* outcomes.

Synchrono® has developed four categories of Demand-Driven Manufacturing operations metrics for action. These are not metrics intended for overall business analysis. Instead, the intent here is to cut through the clutter of the all too often, and all too many, contradicting measurements and focus on the metrics that are going to provide insight to drive action. Action to improve flow, manage constraints, direct continuous improvement efforts and more. The goal is to provide real clarity around the elements that drive organizational excellence and enhance demand-driven results.

In working with hundreds of manufacturers around the globe, we've found that the key to monitoring meaningful metrics – and driving desired results – is in making the data universally visible, in real-time, throughout the organization. See how this can be enabled through SyncView, our visual factory information system.

OPERATIONS METRICS FOR ACTION



Click on the Metrics for Action map to explore the categories and individual metrics.

KEY

Red	= Metric categories
Blue	= Operations and Supply Chain metrics that indicate overall health
Green	= Metrics that are supportive of the Blue metrics at a more localized level

OPERATIONS

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Metrics that drive action in Demand-Driven Manufacturing Operations

The following operations metrics put the focus on inventory management and optimizing the effectiveness of the end-to-end production process. For each metric, we designate whether it is measured at the Global (plant) or Local (resource) level.

Business value to Demand-Driven Manufacturers:

These Operations metrics help Demand-Driven Manufacturers maintain minimal inventory levels to reduce the costs associated with excess inventory and disruptions to flow.

INVENTORY TURNS

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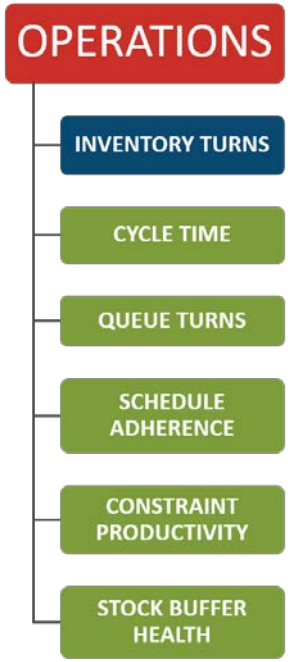

Global Measurement

Inventory Turns is one of the most commonly used supply chain metrics. Inventory Turns is the number of times inventory is replaced in a given period of time. It is calculated by:

Inventory Turns
= Cost of Goods Sold / Average Inventory Value

Action:

While appropriate Inventory Turns rates may vary based on industry, the following general guidance applies:

- **Low Inventory Turns:** First, identify the source of low inventory turns – is it demand, work in process (WIP) or raw materials?
  - Demand: If the level of demand has slowed, eliminate or reduce on hand inventory.
  - WIP: If you have a high level of WIP, work on improving your manufacturing processes to reduce WIP inventory.
  - Raw materials: If you have high levels of finished goods or raw materials, improve your methods for determining inventory targets.

(continued)

INVENTORY TURNS

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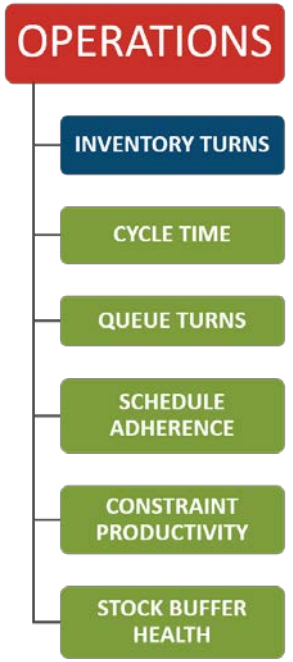
Action:

- **High Inventory Turns** typically signals that inventory is moving rapidly and production is flowing, indicating healthy inventory management.

Note: Because SyncManufacturing software monitors *actual* usage, users of this system would measure actual Inventory Turns rather than average, or estimated turns. In this case, the calculation is:

Inventory Turns
= Actual Usage / Average Inventory Value

This system supports a comparison of Inventory Turns at the product, or item number level.



CYCLE TIME

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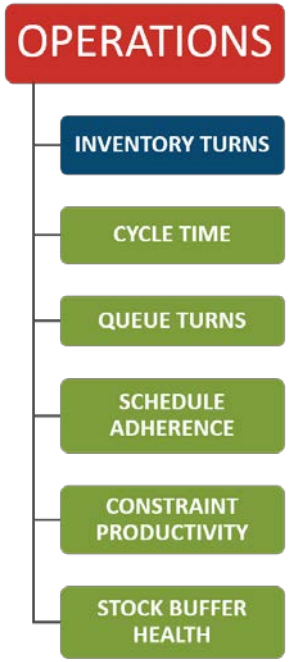

Global Measurement

Cycle Time is the total amount of time it takes to complete an order - from the moment the order is released into production to the time it is completed (when the last production transaction has been recorded). This metric is valuable in identifying how much total production time (including wait time) you have in your pipeline and/or which steps in the aggregate process are longer compared to others. Cycle Time is calculated by:

Cycle time

= Time Order is Completed - Time Order is Released to Production

Action:

Monitor Cycle Time on an ongoing basis for trends. Cycle Time trending upward typically indicates a performance issue - a system bottleneck, maintenance need, etc. Cycle Times trending downward indicate effective flow; perhaps as a result of releasing a bottleneck or improving the performance of a machine.

Measuring Cycle Time can also identify variability. For example, if there is low variability in the Cycle Time for a given product, the quality of promise dates to customers will increase.

QUEUE TURNS

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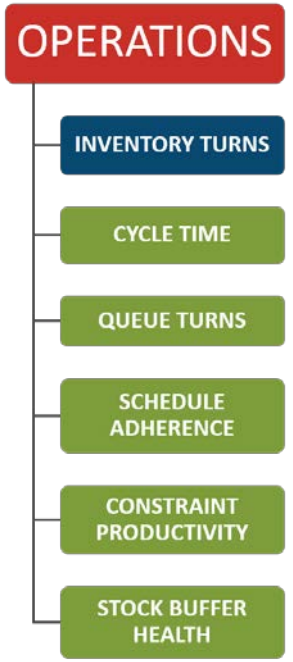

Global Measurement

Queue Turns is a metric specifically associated with Demand-Driven Manufacturing that measures how often the queue turns in front of a resource over a given time period. The queue is measured by the total run and setup time (in hours) associated with the orders waiting in queue. This metric is key to flow considering that in typical environments, 85-90% of cycle time represents items waiting in the queue. A Queue Turn is calculated by:

Queue Turns
= Produced Hours / Queue Hours

Example:

If you have 50 hours of queue in front of a resource and you produce 10 hours on an average daily basis, it will take you 5 days to turn through the queue.

5 = 50 / 10

(continued)

QUEUE TURNS

OPERATIONS METRICS FOR ACTION Guide

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Action:

Queue Turns will be healthy if you have a good, consistent level of work flowing through production, along with a workforce that readily responds to priority orders that need to be completed.

Break down your value stream to see which work centers are turning more slowly. (This exercise may also contribute to a deeper level of analysis that can lead to improvements in Cycle Time.) A work cell with a low Queue Turn rate may point to a policy issue that indicates how your production environment is able to respond to priorities. For example, staffing levels, when and how long you run a resource, etc., could contribute to a low Queue Turn rate. A work center with low Queue Turns may also be a good candidate for your next continuous improvement event.

If Queue Turns are fluctuating for a given resource, look into the batching practices of an upstream resource as the probable culprit.

OPERATIONS
INVENTORY TURNS
CYCLE TIME
QUEUE TURNS
SCHEDULE ADHERENCE
CONSTRAINT PRODUCTIVITY
STOCK BUFFER HEALTH

SCHEDULE ADHERENCE

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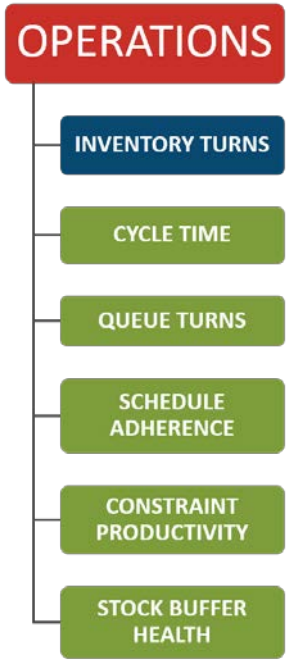

Local Measurement

Schedule Adherence demonstrates the effectiveness of your manufacturing operation in working through the queue in the appropriate sequence, according to priority. That is, how well you were able to stick to the scheduled plan. Operators who work lower into the priority list and do not complete available orders of higher urgency will impact the Schedule Adherence measurement. Variations in adherence typically result in due date risks, which may affect the overall On-Time Delivery metric.

The Schedule Adherence metric is based on taking a snapshot of the queue at a particular time and comparing the completed orders at the end of the period against the available work at the time of the snapshot. If orders that were available to work on were skipped - and lower priority orders were worked on instead - then the area would not get credit for the out-of-order work completed as “good hours”. Schedule Adherence is calculated by:

Schedule Adherence Rate

= Total Produced Hours – Hours Produced out of Priority
/ Total Produced Hours

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SCHEDULE ADHERENCE

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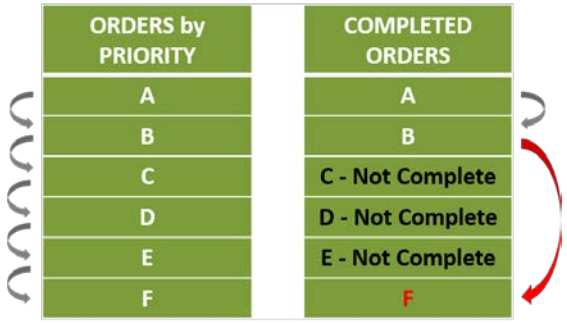
Example:



In the above example, hours for completed orders C-E would be recognized as produced out of priority and therefore the hours completed for F did not adhere to the organization's priorities.

Note: Orders that become available to be worked within the middle of the period are also taken into account. The calculation would estimate what the priority level (and sequence within the rest of the queue) would have been at the time of the snapshot had the order been available to work. Considering this, the calculation will treat the new order like it was there over the whole period and considered accordingly.

Action:

A consequence of deviating from the scheduled plan is the negative impact to downstream production and potentially, in the ability to deliver an order on time. A sure way to drive Schedule Adherence is to measure an individual's or cell's performance based on this metric. As in Eli Goldratt's famous quip, "Tell me how you will measure me and I will tell you how I will behave."

OPERATIONS
INVENTORY TURNS
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STOCK BUFFER HEALTH

CONSTRAINT PRODUCTIVITY

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Global and Local Measurement

Demand-Driven Manufacturers manage their constraints to drive continuous flow. The Constraint Productivity metric is important in monitoring whether constraints are operating at their optimal capacity.

Constraint Productivity can be considered at both a global (plant) and local (resource) level. At the local level, the focus is on a resource constraint. At a global level, the focus is on overall throughput based on the constraint. Ultimately, the constraint is the pacemaker of the system, so by understanding the constraint productivity, you understand the flow of the entire system. Constraint Productivity is calculated by:

Constraint Productivity
= Actual Production / Capacity

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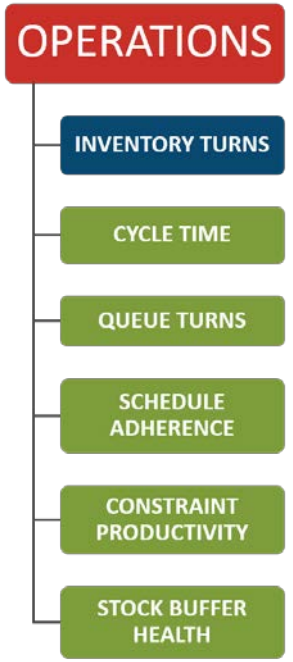

CONSTRAINT PRODUCTIVITY

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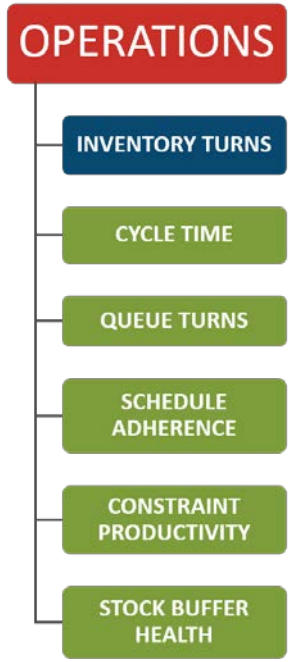

Action:

Keep in mind that resource productivity is only valuable at the constraint resource, which is why the metric is called Constraint Productivity. A principle of Demand-Driven Manufacturing is that non-constraints do not need to have their productivity measured since they only need to be doing enough work and at a pace that will not starve constraint resources of work.

To establish this pace, identify the level of work-in-process (WIP) inventory needed to achieve optimal flow through the production process, e.g., the amount of WIP necessary to avoid starving the constraint (but no more than that). You want to get to the point where you are releasing work into production at a pace that equals the constraint resource's production levels. This is the pace to optimize constraint productivity. (Read CONLOAD for more information.)

Commonly, measuring and therefore maximizing productivity at non-constraint resources actually has the opposite effect on overall productivity. This behavior quickly increases work-in-process (WIP), which in turn:

- Slows down the overall throughput of the factory
- Ties up more capital and cost at a given time
- Puts on-time deliveries to customers at risk
- Prevents the plant from being able to react to the most important and priority orders

STOCK BUFFER HEALTH

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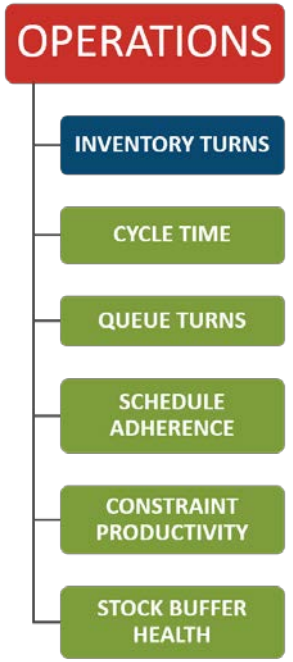

Global Measurement

Stock Buffer Health is the supply of inventory you keep on hand to safeguard against unforeseen demand. First, you need to have a system for indicating the status of inventory levels that represents a range of low to excess inventory. In our example and calculation, we are using red-yellow-green as our status indicators, where red equals low and green represents an overstock of inventory. Based on our example, Stock Buffer Health would be monitored based on the:

Percentage of on hand inventory items in the red, yellow and green status levels.

Action:

First, create ideal inventory targets based on average levels of demand and variation. Next, establish a method for evaluating your inventory targets against actual usage. Then, monitor the percentages associated with each status level over time to identify trends. In our example, if you consistently have items in a red or green status, it indicates that your method for establishing inventory targets needs adjusting.

The following actions are based on our red-yellow-green example:

High percentage of yellow: This is ideal and indicates a balanced level of on hand inventory.
High percentage of green: Indicates that your inventory target is high compared to your actual usage. Trim quantity to reduce on hand waste and achieve a greater percentage of yellow.
High percentage of red: Indicates that you are below your safety stock level and are at risk of inventory shortage. Increase the level of on hand inventory to achieve a greater percentage of yellow.

SUPPLIER

OPERATIONS METRICS FOR ACTION Guide

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Metrics for driving action in Demand-Driven Manufacturing Supplier relationships

Supplier metrics reflect how the supplier's performance is impacting production. Supplier metrics are measured at the item, supplier and plant level.

Business Value to Demand-Driven Manufacturers:

These Supplier metrics help manufacturers drive just-in-time replenishment of quality parts to keep costs associated with inventory and waste down and keep production flowing.

OTD

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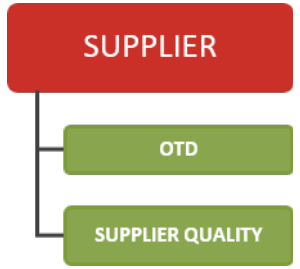

Global Measurement

A supplier's On Time Delivery (OTD) rate reflects the percentage of deliveries received on the agreed upon date. OTD is calculated by:

OTD
= Sum of purchase order line items received on time
/ Sum of total purchase order line items

Action:

You want to keep your good suppliers - those that are providing quality materials on time and at a fair price. Reach out to help them find ways to align with your Demand-Driven Manufacturing strategy – and your OTD goals.

One option may be to implement an automated eKanban inventory replenishment system such as SyncKanban, to delivers real-time replenishment signals to your suppliers through an online portal.

SUPPLIER QUALITY

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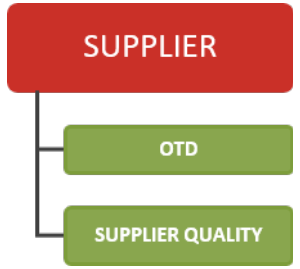

Global Measurement

The Supplier Quality metric tracks the percentage of quality parts/materials received from a supplier. Supplier Quality is assessed according to:

Supplier Quality Rating

= Total number of parts received from the same supplier over a specified time period / Number of parts from a supplier that pass quality inspection

Action:

If a good supplier is falling below expectations, invite them to visit your facility to experience the issues you are having and work together - with your engineers - toward a solution. Your suppliers will appreciate the opportunity to help get it right.

CUSTOMER/SALES

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Metrics for Action in Demand-Driven Manufacturing Sales and Customer Relationships

The method of Demand-Driven Manufacturing drives production based on actual customer demand either through customer orders or inventory consumption. As such, Demand-Driven Manufacturers have a laser focus on satisfying the needs of their customers. The metrics identified here are measured at the global (plant) level and are associated with being responsive to customer demand.

Business Value to Demand-Driven Manufacturers:

Manufacturers increase customer satisfaction and capacity while gaining competitive value.

OTD

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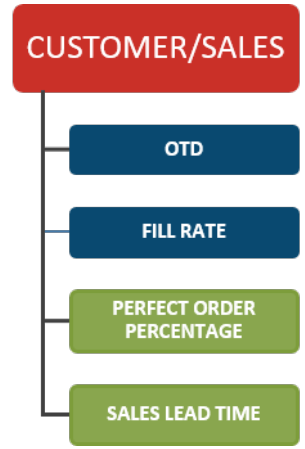
Global Measurement

A manufacturer's On Time Delivery reflects the ability of their processes and supply chain to achieve agreed upon client delivery dates. OTD is calculated by:

OTD Rate

= Total number of orders shipped on time in the period
/ Total number of orders due in the period



Action:

A low OTD could be indicative of any number of issues, including bottlenecks in the supply chain and/or inefficient processes. Many times this is due to a lack of synchronization (particularly with the sales team; resulting in over-committing to customers) and not releasing work into the system at a pace that the constraint resource can effectively process. Review subordinate Operating and Supplier metrics to find issues that may be impacting your OTD rate.

Starting on-time, and when you can fully execute the order, is the only way to deliver all orders on-time.

FILL RATE

OPERATIONS METRICS FOR ACTION Guide

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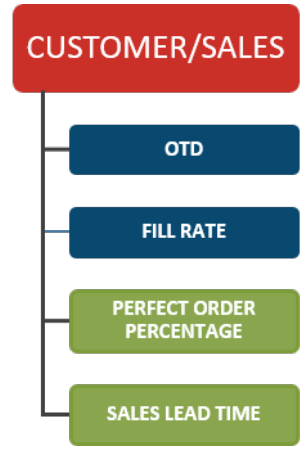
Global Measurement

The Fill Rate reflects the manufacturer's ability to have the item in stock when requested by a customer.

Fill Rate
= Number of order lines available
/ Number of order lines requested by customer



Action:

Take a look at your finished goods inventory management practices and consider moving towards a consumption-based replenishment model with less reliance of forecasts.

An eKanban system that automatically replenishes inventory based on real-time demand signals (actual consumption) is an effective, affordable option. (The white paper, *Gaining Control: Exploring Push v. Pull Manufacturing* discusses various types of Kanban systems.)

PERFECT ORDER PERCENTAGE

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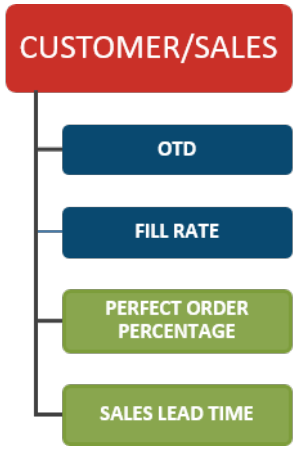
Global Measurement

The Perfect Order Percent metric represents the number of orders (with all line items) shipped on time and without incident. The Perfect Order Percent Index is achieved by multiplying the following percentage rates:

Perfect Order Percent Index

= (OTD) (Orders shipped complete) (Orders shipped damage-free) (Orders shipped with accurate documentation)



Action:

For more insight into the Perfect Order Percent Index, compare scores between different classifications, such as by product, by customer, etc. This analysis may reveal where certain types of orders are negatively impacting the overall Perfect Order Percent Index and therefore areas for improvement.

Also consider practical ways that can help any member of the organization contribute to the Perfect Order Percent Index. One facility, intent on achieving perfect order status, created a screen simulation that included visual representations of all the components of an order. Workers were required to match actual components to the screen simulation before packaging them. In this environment, the variable that needed improvement was the "orders shipped complete" part of the equation.

Identify the variable(s) that is causing issues and team with the workers in that area to map out a solution. Refine, test and repeat until you land on a Perfect Order Percent Index that you can sustain.

SALES LEAD TIME

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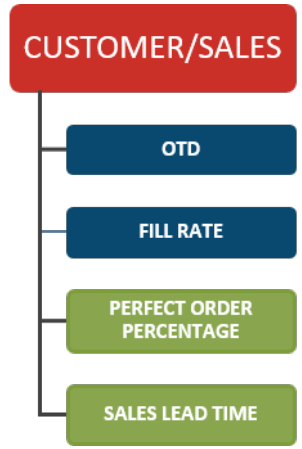
Global Measurement

Sales Lead Time represents the amount of time between order inception and customer delivery. The purpose of this metric is to uncover any constraints pre- and post-production of an order so they can be addressed and managed. Sales Lead Time expands upon the Cycle Time metric (in the Operations category) to include the time and activities *prior* to releasing the order into manufacturing as well as post production shipping and delivery. Sales Lead Time is calculated by:

Sales Lead Time
= Date of customer delivery - Date of customer order receipt



Action:

The ability to shorten lead time drives customer satisfaction and can be a competitive differentiator. Long lead times can indicate unmanaged resource or supply constraints. To shorten the Sales Lead Time, start by dissecting the different components of the overall timeline:

Order Creation > Order Release > Order Start > Order Completion > Order Shipped > Order Delivered

You may find constraints across the organization, at various stages of the timeline. For example, a constraint in the sales area may be the ability to gather all the necessary information from the customer to complete the order. And engineering may have setup constraints while scheduling may have time constraints impacting the release of the order into production. Identify all constraints and chart a path for continuous improvement.

QUALITY

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Quality Metrics for Action in Demand-Driven Manufacturing

From a customer-centric Demand-Driven Manufacturing perspective, the quality metrics worth measuring are those that can directly impact the customer and therefore, profitability. All of these Quality metrics are measured at the Global (plant) level.

Business Value to Demand-Driven Manufacturers:

These Quality metrics help Demand-Driven Manufacturers pre-empt issues that may impact quality with real-time insight into performance indicators.

RMA

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Global Measurement

The RMA (Return Material Authorization) metric refers to the number of times a customer returns products based on quality, obsolescence and failure to meet requirements. RMA is calculated by:

RMA Percentage

= Number of RMAs issued in a given time period
/ Total number of deliveries for a given time period

Action:

Isolate the reasons for return by capturing as much data as possible from the customer. Identify if the issue is based on processing techniques, materials provided from certain suppliers, or shipping and handling issues.

YIELD

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Global Measurement

Yield is the percentage of products that are manufactured correctly the first time, without any quality issues, scrap or rework required. Yield is calculated by:

Yield

= Number of products with no issues in a given time period
/ Number of products manufactured in a given time period

Action:

Based on historical data, establish a reasonable Yield benchmark to measure against with the goal to increase that benchmark over a given period of time by looking for opportunities for continuous improvement. For example, review any contextual data you may have around the quality issue to determine the root cause of the problem - then take action. Data aggregators and historian systems like SyncOperations that collect and analyze real-time machine and system data can help to quickly pinpoint the root cause.

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Additional Resources:

DEMAND DRIVEN let's talk... PODCAST

Podcast: Experts discuss Demand-Driven Manufacturing concepts and provide practical tips and real world examples.

Video: Monitor metrics and more in real-time with SyncView visual factory information system

DEMAND DRIVEN let's talk... MATTERS

Blog: Articles on Demand-Driven Manufacturing strategies, best practices and more from a variety of bloggers.

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