The Complete Guide to Supply Chain Metrics

Learn How to Identify, Measure, and Report

SCE System Performance
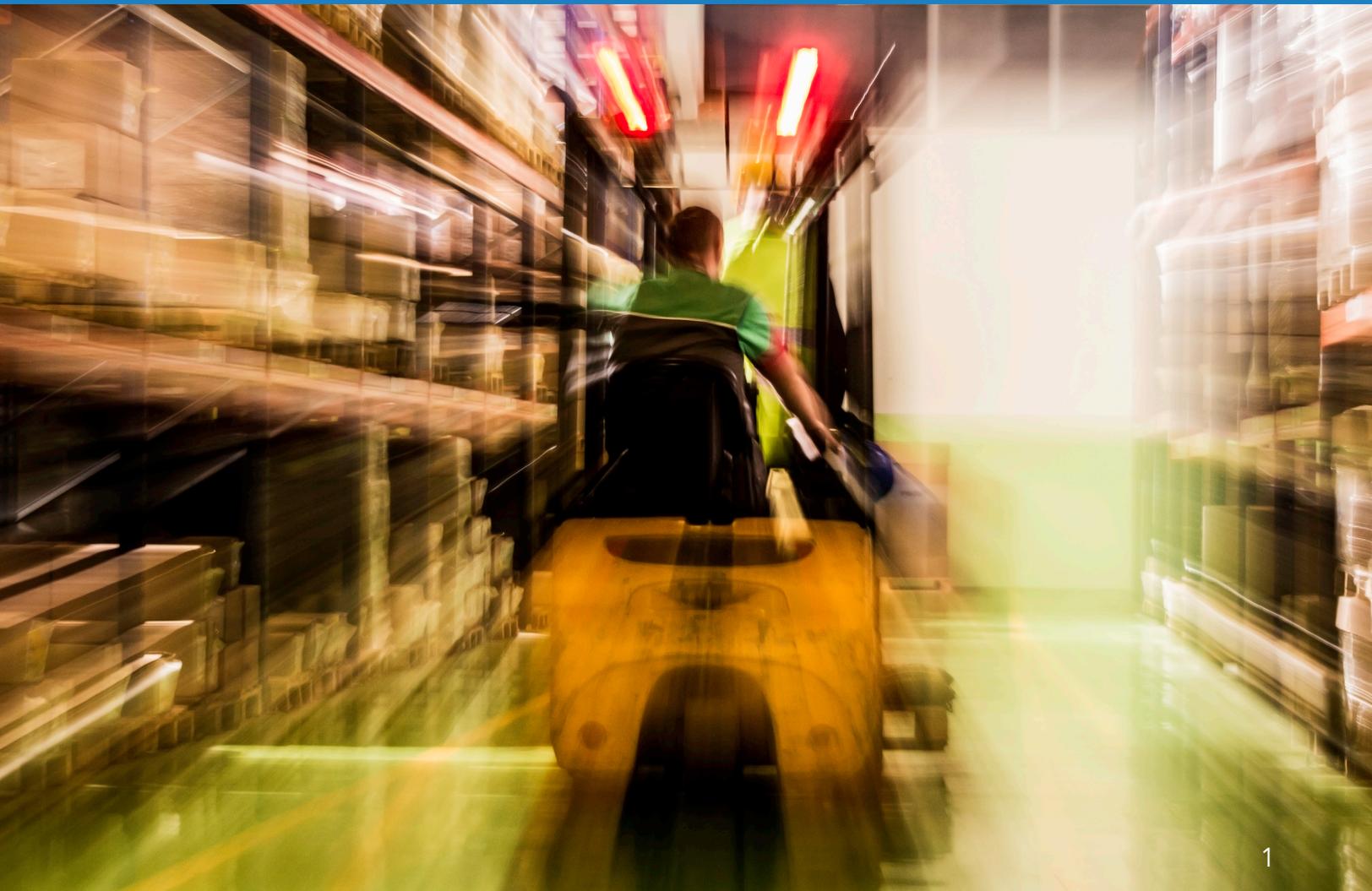
Table of Contents

Introduction: Metrics Programs Are Key to Supply Chain Success

4SIGHT team members average 19 years of experience in supply chain. This means we've all worked with dozens of companies over the years to improve their supply chain performance. One commonality we've noticed is the presence of metrics: They are attached to bulletin boards, posted in work areas, and discussed in team meetings. Metrics play a key role in the profitable management of a warehouse and in an organization's overall supply chain success. As such, leaders should establish a metrics program and review it periodically to ensure metrics are accurate and pertinent to the latest business goals.

In this guide, we'll take you through the process of identifying your key metrics, measuring performance in operational areas, and using these metrics for overall Supply Chain Execution success.

Part 1: The Four Steps to Identify Key Metrics

When your company implements a new Supply Chain Execution system (Warehouse, Labor, Yard, or Transportation), it's an excellent time to evaluate your operations and metrics programs. Without accurate and pertinent measurements, it's difficult to gauge the success of the implementation. A solid metrics review and ongoing revision are key to a successful project implementation. However, reviewing and updating metrics programs can be a large task, and it may be difficult to figure out where to start. **Here's how to do it.**

STEP 1:
List the metrics required to maintain operations.

The first step is deciding what needs to be measured and how much control the operations team has over the elements. There may be corporate-mandated metrics that need to be maintained, but they should be reviewed carefully to ensure they are in sync with operations. When referencing existing or past metrics, there is always the chance that the metrics were built on older operational guidelines that are no longer valid. Metrics that are totally owned by the operations team should be reviewed top to bottom, with a focus on improvement.

STEP 2:
Identify any other metrics pertinent to operations.

Because there are so many possibilities for metrics that can be tracked, this step must be approached carefully. Below are a few starting points:

Reference industry standards that best-in-class companies follow. Look to industry professional organizations for help in this regard. They often research and publish industry-accepted metrics. Two good resources are the Warehousing Education and Research Council (WERC) and the Council of Supply Chain Management Professionals (CSCMP). Additionally, there are supply chain consultancies which can assist you.

Talk to your associates and team leads. They are a great source of knowledge gained by performing their jobs day in and day out. The experienced hands can provide guidance on the steps they use to measure how much work is being performed correctly, and where the fluff lies. They know the tricks of the trade and how work really gets done. This group needs to be engaged in an open and cooperative manner.

Be ready to learn how some of your associates have been "gaming" your metrics. This is a sign that your metrics should be constructed better, and that they may not be measuring what you think. This input is very valuable, and you may want to consider a "bounty" for the "tricks" that associates use. However, this approach depends on your environment. In some warehouses, associates compete to outdo each other and brag about their "tricks," which can encourage a spirit of friendly competition. In others, the associates would prefer to submit their "tricks" anonymously, or not at all. Consider the types of metrics that will be supported by your company culture. A team-oriented culture will want to set team/area/shift metrics, while a gain-sharing culture may look to establish specific associate-accountable metrics.

STEP 3:
Maintain a manageable number of metrics.

After finishing Step 2, you will probably be staring at a list of suggested metrics a yard long. Too many metrics can become unmanageable quickly, so the goal is to maintain a reasonable number of truly pertinent metrics. The number and type of metrics will differ depending on who is using them and the topic.

Management

High-level metrics for management often will be accessed via an interactive portal. Typically, these are macro performance indicators used to manage the business, and while current, they may not be real-time measures. Often, there may be a dozen or more and can include multiple facilities and different disciplines, such as transportation and inventory management.

Supervisors

Line-level supervisors/first-level managers need measures that are more reflective of the facility and area performance. While they need to know how their focus area is performing against monthly/weekly targets, they also need to be able to keep their finger on the pulse of daily activities in real time. For example, at two hours before a carrier leaves, how many orders have been fulfilled completely, and how many remain?

Floor Associates

Floor associates need to focus more intently on their job on a minute-to-minute basis. Too many metrics will create an environment where it becomes difficult for them to prioritize effectively. Their metrics must be concise (five or fewer) and ideally accessible in real time (or as close as possible). Likewise, team performance is also critical. If members of a team can easily access the performance of their area, they tend to self-manage to reach their goals. If associates can see their remaining orders at two hours prior to cut-off, most teams will adjust their efforts as necessary to make sure they meet the requirement.

STEP 4:
Stay on target.

Metrics must be pertinent and accurate to contribute effectively to a well-run operation. Notice that the paragraph above reads "most teams will adjust their efforts as necessary to make sure they meet the requirement" instead of "most teams will increase their efforts as necessary to make sure they meet the requirement." People perform to how they are measured. It is not unusual to see a team relax their pace if they can do so without missing their target just as they will speed up to hit a higher target.

What is the real goal of the measurement program? If it is simply to fulfill all orders by cut time, perhaps the above metric is satisfactory. If it is to reduce labor, perhaps the above metric should show the number of associates needed to meet a specific workload. Does each area/job function need its own metrics, or are metrics applicable across a facility? For example, the simple metric of picks per hour is not one that can be shared across all job functions; a picker

in a pick-to-light area will have a much different rate than a bulk-item picker. Each metric must be placed in context, such as by area/function.

There are many nuances to managing a metrics program. Metrics must be reviewed regularly to ensure they remain on target and pertinent to today's operations. If a company institutes engineered standards, they can define more precise and accurate metrics. One of the keys to metrics maintenance is a consistent review of standard processes. Continuous improvement teams are great for this purpose.

Goals vs. Metrics

Keep in mind that goals and metrics are different, although sometimes the terms are used interchangeably. A goal is a measurable outcome or end point. A metric is the system of measurement used to determine your performance. The goal may be arriving in Las Vegas at the end of the week after a cross-country drive, while the metrics are measured by your dashboard instruments. As your goals change, your metrics must change along with them.

Part 2: How to Successfully Measure Performance by Operational Area

Metrics for Effective Supply Chain Execution

Now we'll look at specific examples of some of the more common and effective metrics used in warehousing and distribution to give you a good head start on developing your own. Modern Supply Chain Execution systems (Warehouse, Labor, and Transportation) produce a tremendous number of data points for metrics to use in building the foundation of a continuous improvement program. Keep in mind the basic tenets of effective metrics programs: They must be pertinent, and the number of metrics should be manageable for your operations. If you include too many metrics, users will be swamped. Company and facility culture also play roles in determining which metrics should be Key Performance Indicators (KPIs).

Metrics typically are black and white objective data, so how can a company's culture affect them? After all, time doesn't flow any differently depending on your company culture. Company culture directly impacts how metrics are developed and used.

Compare a gain-sharing environment that focuses on individual productivity to a team-based, flexible environment. In gain-sharing, metrics usually concentrate on individuals, such as how well a picker performed against established standards. In a team-based environment, metrics may reflect the conditions of a certain area of the warehouse, such as how many picks have been completed versus how many remain for the shift.

Two notes: When you review your metrics, consider performing a "5 Whys" analysis of the results. You'll learn more about this approach in part three of this guide. Also, if engineered labor standards (or any other standards) are in place, metrics should be balanced against them to ensure performance is meeting expectations. Standards should be revisited occasionally, especially when product lines, warehouse configurations, or technology tools change.

INBOUND PROCESSES

Dock-to-stock

This represents the amount of time that elapses between when a product arrives and when it's placed in stock. If a product is not in a picking position available to be shipped to a customer, then it's just a drag on your operations and cash flow. This should be measured for physical activities as well as Warehouse Management System (WMS) activities. Don't rely solely on timestamps in the WMS, because if product arrives shortly before a break or shift end, it may sit on the dock before being logged in the system.

There are often three major types of product receipts:

NEW	ESTABLISHED	INBOUND INSPECTION
A new product that must follow a "new receipt" process	An established product that does not require formal inbound inspection	A product that requires inbound inspection

Differentiate among products that have characteristics which impact receiving and handling speed, such as expiration date, batch required, serial number, etc. If product needs to be segregated at receipt, include that physical segregation time in your metrics; it can be tracked separately. This may have to be captured the old-fashioned way with an observer and a stopwatch because this activity often is managed outside of the WMS.

Additional metrics to consider

How much time is required for product inspection?

What is the pass rate of inbound product?

How much product arrives damaged?

How long does it take to transport product from the dock to its storage location, making it available for picking?

    Does this vary by product type?

    Is there variance within a specific equipment type used to put product away?

Truck time at the dock

Do trucks arrive near the expected arrival time? Even if you do not use appointments, your supplier should be able to provide you with an ETA.

Do you use appointments, and if so, how accurate are your appointment times?

    How often does a delivery truck wait past the appointment time due to delays in the warehouse?

How long does a trailer stay on the lot before it's hooked at a door?

How long does it take to check in a load and review the paperwork?

How long is a trailer at a door before unloading begins?

How long is the unloading process on a trailer?

Once a trailer is unloaded, how long until it is released from the dock and departs the yard?

Order fulfillment

On-time delivery percentage: Out of the total orders shipped in a day, how many were shipped according to the promise date?

> Does it matter to your customers if an order ships early, or is this considered "on-time?"
>
> You could consider using "delivery date" as a measure, since this likely is more important to your customer. However, deriving delivery date is a more complicated measure and may not be worth the extra effort and expense depending on your customers and carrier reliability.

Total orders shipped: Complete, partial, backorders.

Order fill rate: Orders filled complete on the first shipment.

Order accuracy: Total number of orders shipped.

Order line accuracy: The number of lines shipped correctly out of the total number of lines shipped.

Skips and alternate picks: How often a picker skips the originally scheduled pick task/ assignment and how often an alternate (location or item) is picked.

Order cycle time: How long it takes to fulfill an order after it was placed or dropped to the warehouse.

Rate of returns: The number of orders/lines/SKUs returned or credited in some fashion.

Order fulfillment metrics can be tracked using different denominators, depending on which is more important to your operations. Some of the more common metrics include orders shipped:

- During a clock/shift hour
- During a shift
- Per associate (define which associate role is used, such as picker)
- Per total labor hours
- Per total associates/full-time employees

Determine which metric fits your operations more closely, and go with that. The total per facility is often the easiest to calculate and can be done as the number of orders per day divided by working hours. As you get further into details, it may become easier to tease out the numbers on a rolling hourly time frame or by other factors, if they are pertinent. At the highest level of metrics, engineered standards can be implemented for objective baselines. Picked/packed/shipped orders, lines, and items are often tracked per hour.

Outbound trailer time at the dock

Use similar metrics as suggested above for inbound, except with an outbound focus.

Do trucks arrive near the expected arrival time for pick-up?

_____

Do you use appointments, and if so, how accurate are your appointment times?

     How often does an outbound truck wait past the appointment time due to delays in the warehouse?

_____

How long does a trailer stay on the lot before it can be hooked at a shipping door?

_____

How long does a trailer remain at a door before loading begins?

_____

How long does it take to prepare and distribute the shipping paperwork, including applying pro numbers?

_____

How long is the loading process on a trailer?

_____

Once a trailer is loaded, how long until it is released from the dock and departs the yard?

The Perfect Order Index

The "Perfect Order Index" has grown more popular over the past several years. It is a measure of how many shipped orders are "Perfect" compared to the total number shipped. This metric considers many different aspects from the customer's viewpoint and requires a customer feedback loop. If you are new to a metrics program, you may want to start with some of the more basic ones listed above, as they work very well in many environments. Components of the Perfect Order Index include:

The order was entered into the system correctly and in a timely fashion.

The order was delivered to the customer at the right/expected time. (See above comment re: on-time/early shipments)

The order was filled accurately – no short picks or errors.

Items arrived undamaged.

Items were packaged in a manner expected by the customer (if they ordered a case-pack, they received a case-pack, not a collection of eaches).

The paperwork is accurate and timely: packing, shipping, and invoice documentation.

Inventory Management

Inventory accuracy: This is the actual quantity per counted SKU vs the WMS-listed quantity. Be aware that some people may look at this from an accountant's view and consider the costs of counted on-hand inventory versus system-listed inventory. This can be quite deceptive as a small difference in a high-cost item can overshadow large differences in low-cost items.

Damages: Amount of inventory recorded as "Damaged."

Number of days on hand of inventory: The inventory value divided by the value of the average daily shipments.

Inventory turns: How many times your inventory "turns over" in a year; divide the cost of shipped material by the cost of total inventory on hand.

Storage utilization in the warehouse: The number of square feet occupied with product vs. total square feet of storage capacity.

> Some environments measure cubic feet utilized, such as in a high-density frozen goods warehouse.

> Calculating the number of locations used vs. the total number of storage locations is also very useful, especially when broken down by storage location type/size.

Inventory adjustments made: This can be compared to credits issued to customers to provide a more complete picture.

Tracking adjustments to cycle counts:

> How many adjustments are being made, and what magnitude are they?

> How many are initiated via a primary counter versus a secondary counter performing recounts?

Carrying cost of inventory: What does it cost to have product in your warehouse?

Transportation Management

Cost of freight per unit: The average freight cost for an item to ship to a customer.

Average freight cost per order: This can be broken down by shipping region for better clarification. Cost should always be differentiated by mode.

As you can see, there are many metrics that can help you manage your warehouse more effectively. There are others that focus more on the personnel management and health and safety areas, such as injuries, near-misses, employee turnover, and a host of financial statistics that come into play in a more strategic view of the operations. The ones listed above are more tactical measurements which are closer to the associates.

The journey to well-controlled metrics/KPIs is a never-ending one. Performance will improve over time, assuming your operations and management encourage adherence to them and that they maintain their relevance to the workforce.

A few suggestions to help ensure this include:

If milestones are established that require substantial improvement, it is advisable to create intermediate goals. This helps associates focus on near-term activities and performance, so they can see and feel the results of meeting these goals.

Some areas of operations may have to be prioritized ahead of others.

Be aware of establishing too many metrics and goals because this can become overwhelming for the associates and for those responsible for collecting and processing the data.

Always make sure that you clearly define what milestones are being pursued and how you will get there together.

Establishing and maintaining expectations is critical to successful teamwork.

Part 3: Using Your Metrics for Effective Supply Chain Execution

Now that we've reviewed the elements of effective metrics programs and metrics commonly used in warehousing and distribution environments, what do we do with them? It's one thing to establish and track metrics, and another to put them to use and improve the performance of your facility. So, what's the most effective way to use metrics? There isn't a "one size fits all," or even a "one size fits most" solution because there are too many unique variables at play. **Given this, it's good to start with some fundamentals on how you can use your metrics effectively.**

Communication

As a first step, communicate the metrics to those who will be impacted by them as soon as possible. If tactical metrics are posted to a board only once a month, or even once a week, they lose impact for the associates on the floor. Metrics and results need to be communicated swiftly, accurately, and concisely to have the most influence on the people who create the inputs for them.

For example, if Tom is a picker, and you show him his performance from several days ago, there is nothing he can do about it. However, if he can see his picking performance immediately or at least during his shift, Tom can modify his behavior to meet the goals. This feedback loop can occur in many ways (RF units, digital scoreboards, team meetings, individual reviews during a shift, bulletin boards, etc.).

Data latency:

The lag in presenting data to a user to elicit an action is called data latency.
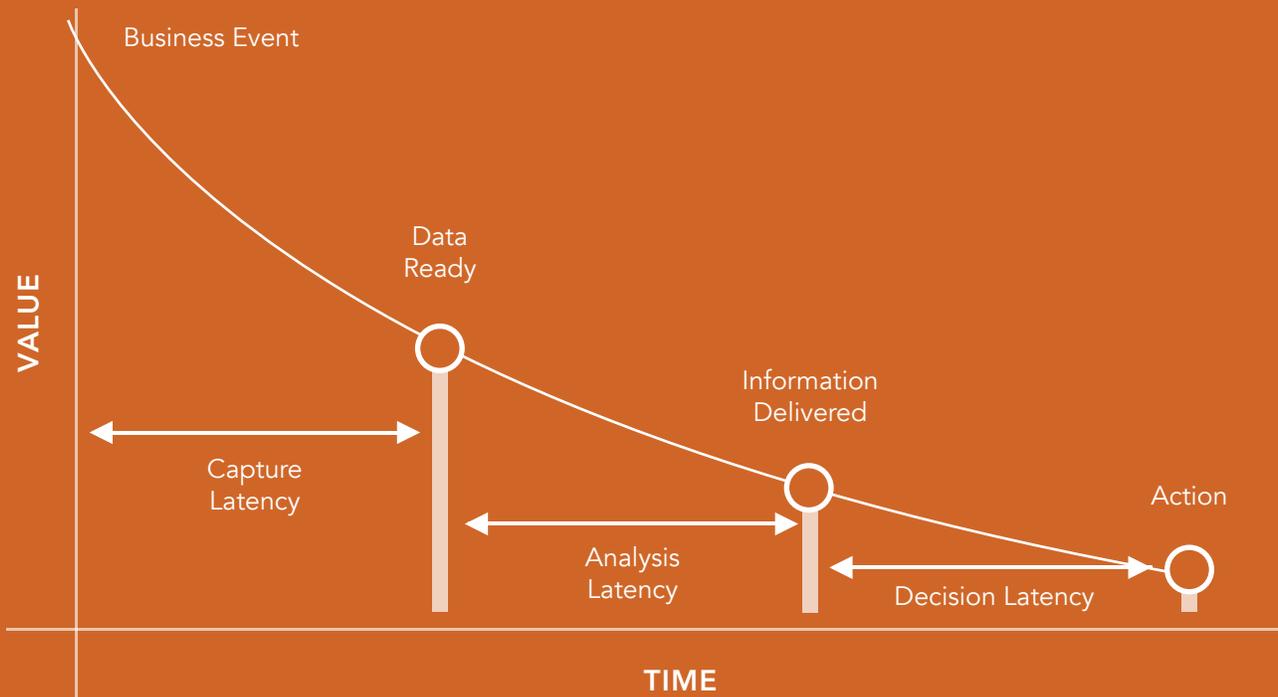
Data latency is a basic concept: It is the elapsed time from when an event occurs (Tom picked a carton) to when he was informed of his performance (he was slower than standard) and adjusts his behavior (the overall "response time"). The shorter this time, the more valuable it is.

If we tell Tom his picking is slow right now, he can speed up. If we tell him his picking was slow last week, he may shrug his shoulders because there is nothing he can do about last week's performance.

When presented with real-time metrics, associates begin to adjust how they work in real time to achieve their goals and improve, and they will also begin to take more ownership of their performance. As long as the metrics are realistic, and the associate can see how their behavior has a direct impact, most will start to take a bit more pride in their work. Giving recognition and praise for their efforts boosts this even more. Before long, you likely will see associates striving to meet their goals and often competing with others to see who can perform more consistently. When they begin to assume more ownership over their jobs, quality will also improve.

However, quick feedback is not a panacea, and it must be approached with eyes wide open. Make sure that your metrics do not incentivize bad behavior. Output from these newly measured actions must be monitored through quality assurance to ensure that processes are being followed properly. For example, one packer's rate may jump within the first few days of the program. However, QA could find that cartons from his workstation are only two-thirds full (remember the section earlier in this guide about how associates can adjust their behavior and game the system!).

Identify Constraints

As you work with associates to review their performance, you are likely to hear "I could have done more if only…." This "if only" part is restricting production, and it should be investigated, especially when multiple associates report the same or similar issues. This "if only" is a bottleneck on the activities in your facility. A bottleneck is a pinch point where the flow of product and/or labor is constricted. This causes the input side to build up and the output/downstream side to have idle time while they wait for product or labor to pass through the bottleneck before they can finish their work.

It's important to find the bottlenecks that are slowing throughput in your facility and supply chain. Once a bottleneck is identified, search for a way to expand the capacity of the bottleneck (exploit it), and if needed, add a buffer in front of the bottleneck so it never has to stop. This can have a dramatic impact on downstream operations. The bottleneck can be anything that impacts production, such as a printer that generates paperwork for a shipment, a specific processing area that must be used, material handling equipment, etc. It can be anywhere. **To learn more about constraints, explore the writings of Eli Goldratt.**

5 Whys Analysis

Now that you and your team have identified issues (constraints), how can you eliminate them? One of the most effective continuous improvement tools is the 5 Whys analysis. This was developed by Taiichi Ohno at Toyota as part of their Lean process methodologies.

At the most basic level, the process consists of asking the question "Why?" through five iterations to get to a root cause of an issue. However, the process isn't as simple as saying "Why?" and expecting magic to happen.

First off, identify a metric, issue, or task that you would like to evaluate, and keep it specific. Don't begin with a wide-open goal, such as "improve the speed in receiving." A good starting point is one of the constraints that you identified above.

Begin with the fundamental question:
Why are picks bogging down on the floor?

The second question may be: Why don't we have enough pick carts available for pickers?

The answer to this question will determine the next line of questioning. There may be multiple answers to the preceding question: The pick carts are already used and staged in packing, empty pick carts haven't been returned to service, pick carts may be damaged and not repaired in time, there are multiple pick cart types and the wrong mix is available, etc.

Follow the direction of this next question and you should get closer to a more specific definition of the constraint causing the throughput delays.

In a perfect world, as you continue to delve deeper into the "Why" aspects of the questions, you will arrive at a process that needs to be tightened up or one that needs to be created. The goal is to find the true "root cause" of the constraint/issue.

The above is a simplification of the 5 Whys process, but when it is given the correct focus and the teams have practice executing it, the approach can start to create noticeable improvements in quality and throughput in your operations.

Some tips that will help you stay on a productive course:

Have a small core of people who engage in each of these analyses. These people will gain experience in leading the questions. They can also assume mentor roles within the analysis teams; they don't necessarily have to lead them. This core is not the entire team; teams also include other associates.

Use cross-functional teams during the analysis. Fresh sets of eyes on problems can produce great results. Ensure that some of the participants have solid hands-on knowledge of the problem area. In a truly cross-functional team, some people will be "outsiders."

Be aware of the tendency to chase symptoms of the problem. The teams need to dig into the problem and ask what happened to create it, but they have to be careful not to venture too far into "what else is affected." A lack of focus will lead to scope creep and may prevent you from getting to a root cause of the issue. More importantly, it may cause participants to lose faith in the process.

Be ready to analyze the same constraint with a different team. It's not unusual for different 5 Whys analyses to produce different results when looking at the same issue. This is a function of the team members, their knowledge, the mentor leading them, and the current state of the issue. Multiple teams may interpret reason paths in different ways, but that can be a strength as you ferret out areas for improvement within your operations.

Place a time boundary on your 5 Whys process. Don't allow one to extend for weeks on end, because participants will be in the weeds by that time. Make it a quick, hard-hitting exercise. The type of operation and depth of the issue will help define the minimum time, because you don't want to shortchange the teams and not allow them to finish, yet they need to drive forward. It's a balancing act that the mentors will learn.

Allow team members to focus on the analysis. Backfill their normal job responsibilities while they are on the team. The analysis isn't meant to take days out of their schedule, so use your mentors to develop reasonable time expectations for your operations.

The team must be able to meet in a collaborative fashion. It is best to have a small conference room with a large whiteboard, so all members can see everything that is happening and not bury their heads in their computer or phone. You may even consider barring computers and phones from the meetings, unless required for specific details related to the issue at hand. All team members are on equal footing during the meetings regardless of their corporate title.

Keep the team size manageable. Six people is often a good working number.

Provide support for the teams' solutions. If solutions are rarely implemented, associates will infer their input isn't valuable, and enthusiasm and quality of effort will decrease. That isn't to say every team's proposal must be implemented as designed by the team. Sometimes the solutions must be tweaked to reflect other considerations, such as adherence with HR requirements.

Mix the teams up. Rotate different associates through them.

Summary

These suggestions are intended to provide guidance as your operation seeks to improve productivity and the bottom line. We hope they help you get your metrics programs off the ground, so they can become useful to your operations. There are many nuances to these approaches, which depend on your specific operations, goals, and culture.

There are also many other approaches to improvement such as Six Sigma, and you may be wondering why we didn't cover them. Six Sigma is a very detailed program that requires the regimented determination and collection of metrics and use of statistical analysis to fine-tune your operations. It requires substantial overhead in training and upkeep. If your company has the personnel and budget to maintain a full-fledged Six Sigma program, then you likely are already familiar with some of these approaches. This guide includes tactics that are relatively easy to adopt for any operation. They provide substantial value and can produce notable productivity improvements without the overhead of Six Sigma.

There is no single metrics solution that fits every business. However, with the tools you've learned here you should be able to get the ball rolling in your operations.

About 4SIGHT Supply Chain Group

4SIGHT specializes in supply chain consulting, engineering, and information technology. Our seasoned professionals average more than 19 years of experience helping companies across all industries solve their distribution, fulfillment, and transportation challenges.

As a testament to the value our clients place on our expertise, experience, and integrity, 4SIGHT has received multiple industry awards. For more information, please email us at **in4mation@go4sight.com**.