MaintainX

Understanding Maintenance Metrics & KPIs Guide

Learn the Secret of World-Class Maintenance Teams: Data-Driven **Decision Making**.

Understanding Maintenance Metrics and KPIs

TABLE OF CONTENTS

01

Maintenance Management Key Performance Indicators

A Key Performance Indicator (KPI) or metric is a well-defined and quantifiable measure that an organization uses to gauge its performance over time. Manufacturing companies specifically use KPIs to monitor, analyze, and optimize operations, often comparing their efficiencies to competitors in the same sector.

One commonly used manufacturing KPI is “overall equipment efficiency” (OEE), measured by calculating the factory’s performance, availability, and quality. An effective measure of performance, especially on the factory floor and machine-specific level, OEE ideally should be used alongside other KPIs to gain greater clarity on performance from multiple angles. Manufacturing businesses can, and should, choose several KPIs to focus on to help guide decision-making.

Why Are KPIs Important?

KPIs are essential for manufacturers because they are defined, measurable metrics that help businesses focus on what is most important to track, analyze, and optimize performance over a period of time.

KPIs let manufacturers know whether they are on course for success, if they are growing, and where issues may be present within their businesses. Having a KPI dashboard readily available can make company and business goals and priorities stay in focus and ensure the organization is moving forward as a whole.

The manufacturing industry represents more than 10 percent of the US economy and more than 15 percent of the global GDP. The only way to stay ahead in this fiercely competitive industry is to implement manufacturing KPIs and metrics.

Everyone strives to increase the top line of a business, trying to gain more market share to increase profits. While this is important, what if you could increase your bottom line without taking on expansion risks? This is where KPIs for the manufacturing industry come into play.

Measuring KPIs

There are many manufacturing KPIs considered standard throughout the industry. However, that does not mean that your company should apply them to your maintenance management. While many of them are applicable, some are not. There might even be the possibility that a standard manufacturing metric does not even exist for what you want to measure. If you are going to create your own production metric, consider the following.

Every KPI needs a **clearly defined goal**. What are you trying to achieve? Is it even something that your company can achieve? What is the time period that you wish to accomplish this goal? Be specific and set up parameters that clearly define your goal. This goal needs to be something that can be numerically defined (quantitative, not qualitative).

It is essential that you can objectively **measure your progress** toward the goal. This means collecting and interpreting data, which brings us to the following.

There must be a clearly defined **data source** with a strict procedure of how the data are measured and collected. There should be nothing left to interpret here.

Reporting your data is just as important as collecting it. Different manufacturing KPIs will have different reporting frequencies.

02

Let CMMS Drive Your KPIs

From https://www.ccr-mag.com/let-cmms-drive-your-construction-kpis/

We know that production losses need to be eliminated. We hear of DOWNTIME, Lean, Six Sigma to reduce waste and increase efficiency, but what can we do on the ground to improve processes? Start by looking at a key performance indicator (KPI) to see how your company is meeting its performance goals.

A manufacturing KPI or metric is a well-defined measurement to monitor, analyze, and optimize production processes. KPI dashboards provide management with valuable business insights to meet their manufacturing goals.

For example, overall equipment effectiveness (OEE) is a metric that indicates the physical condition of the equipment being used and is an important target KPI for most manufacturers because it involves three key indicators:

- Availability: Percentage of time a piece of equipment can operate
- Quality: Percentage of good produced parts
- Performance: Percentage of maximum operation speed used

These KPIs play a considerable role in a company's ability to compete and depend entirely on the peak performance of the company's facilities, equipment, and workforce. Asset and resource availability play critical roles in optimal production.

Improving the performance of manufacturing processes means that overall equipment effectiveness needs measure the types of production losses and indicate areas of process improvement.

What does manufacturing process improvement look like? How does your company's business performance affect your bottom line? As you read the list below, keep in mind that with a modern CMMS/EAM and strategic goals in place, all of these are possible:

- Reduced time spent filing work orders and locating equipment information
- Increased preventive maintenance and decreased production downtime
- Reduced unplanned reactive maintenance and reduced time waiting for spare parts
- Reduced time collecting information for audits, checklists, reports, and inspections

In other words, increase what is good and works, decrease what is bad and does not work.

Industry 4.0 is a data-driven paradigm in which the smart use of data provides all sorts of competitive information about key performance indicators such as productivity, quality, and efficiency.

We know that these days, in the midst of a jittery economy, a company's competitiveness can hinge on integrating and implementing a computerized maintenance management system (CMMS). A modern CMMS supports companies in many ways. Here are just three that will directly affect both overall equipment efficiency and KPI availability, quality, and performance:

- To move from reactive machine maintenance to preventive maintenance,
- To shift from ordering spare parts when needed to running real-time supply-chain inventories, and
- To move hardcopy machine documentation and guidelines into the cloud.

With modern CMMS that collects data on our mobile devices in real-time, you can calculate KPIs to drive your day-to-day standard operating procedures, work order management, and preventive maintenance plans.

Once implemented, computerized maintenance management software empowers and enables mobile workers out in the field via a mobile app. These connected workforces can easily report in real-time completed standard operating procedures and preventive maintenance work orders, update inventory and asset management checklists, and communicate with managers from the spot of the work.

A comprehensive computerized maintenance management system (CMMS) is crucial to KPI success and solves many of the primary challenges in manufacturing maintenance operations. Additionally, these systems enhance overall maintenance performance and reduce maintenance costs.

Manufacturing companies that implement a modern CMMS system can efficiently perform preventive maintenance, avoiding costly breakdowns and downtime and increasing control of maintenance spending to meet optimal performance KPIs.

In fact, downtime reduction is the highest priority for many manufacturing companies. Unplanned downtime has an associated high cost and directly impedes delivering quality products and earning customer satisfaction.

Accelerating the service request process and minimizing the time from request to repair completion, along with improving planning and productivity, is the backbone of KPI efficiency metrics. As technicians become more efficient, the ability to make real progress in shifting toward proactive, preventive maintenance strategies becomes more achievable.

Modern CMMS simplify managing the data and metrics required with easy-to-access asset and maintenance history. Operationalizing KPIs is next to impossible and incredibly time consuming with paper-based systems, spreadsheets, and other older approaches to managed maintenance.

There are many reasons why a CMMS is critical to companies achieving their maintenance goals, but two stand out: asset and maintenance metrics and efficiency gains.

1. Asset and Maintenance Metrics

Manufacturers can analyze asset and maintenance data to identify key areas for improvement. The need for historical and real-time information that is readily available and easily searchable is fundamental to maintenance improvement. Searching within paper-based systems to identify trends regarding equipment failures, etc., is labor-intensive and, amid Industry 4.0, becoming a work habit of the past.

For example, if data reflects that a belt is failing every 150 hours of service, place it on a preventive maintenance (PM) program. The right PMs can help manufacturers avoid the unplanned downtime event completely. With a modern CMMS, managers can easily call up failure data on the belt, look at service hours, check out replacement costs of spare parts, and make an informed decision on whether or not to replace the belt.

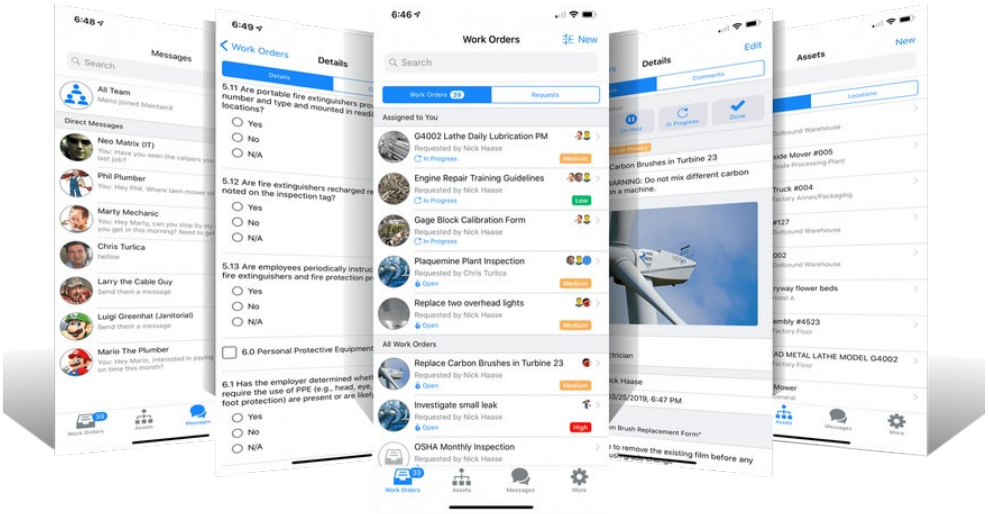
A CMMS is not just about the collection and analysis of asset and maintenance data. It also enables customizable dashboards that report KPIs in real time. In the right hands, these dashboards help managers make informed business decisions—once again extending the ROI on the CMMS.

2. Efficiency Gains

The second core element that makes a CMMS critical to maintenance improvement is efficiency gains. A user-friendly CMMS simplifies the maintenance planning process, streamlines workflow, and increases production efficiency.

For maintenance planning, consider the drag-and-drop calendar function and the capability to see a calendar with all employee tasks and availability from one view in a CMMS. In addition to planning efficiency, overall workflow efficiency also has a significant impact on maintenance performance. It starts with the maintenance request process. With a modern CMMS, this request process is simple, straightforward, and fast. The work request is immediately routed to the right individual for review.

The work order workflow is also simplified with a CMMS. For those using mobile CMMS functions, the work order can be sent to the technician in the field. He has to come back to the shop prior to beginning a repair.

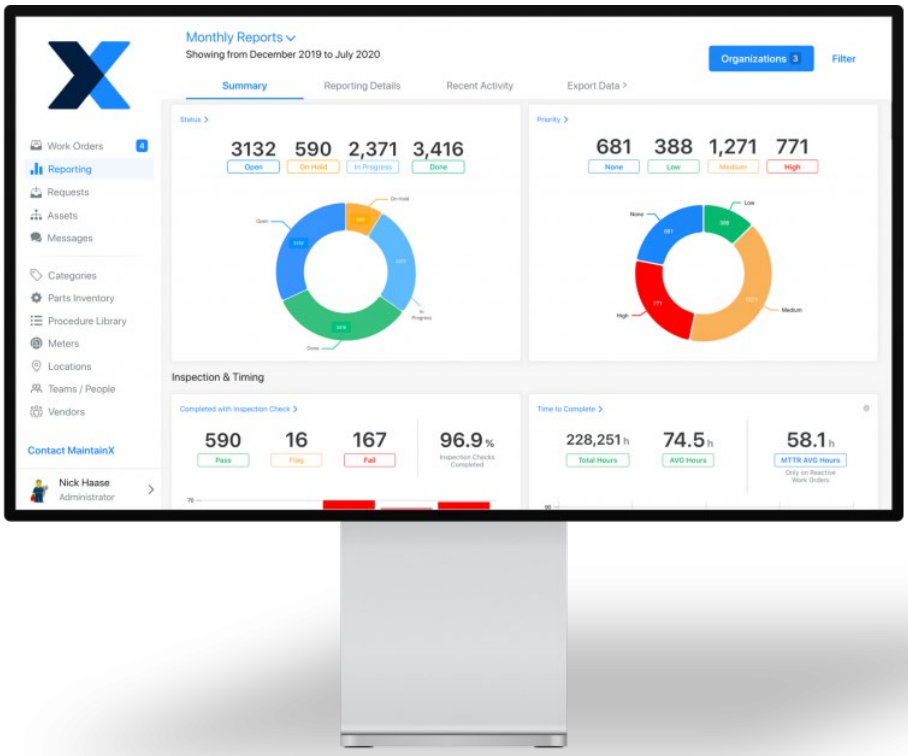


03

CMMS and KPI Reporting

Choose a CMMS that not only compiles equipment data but also translates it into useful and familiar industry metrics. Research scientist Ashraf W. Labib, at the University of Manchester Institute of Science and Technology, describes most off-the-shelf software—especially computer-aided maintenance management solutions and enterprise resource planning (ERP) systems— as "black holes greedy for data input that seldom provide any output in terms of decision support."

"This lack of decision support is a definite problem because the key to systematic and effective maintenance is managerial decision-taking that is appropriate to the particular circumstance of the machine, plant, or organization," Labib says. "This decision-making process is all the more difficult if a CMMS can only offer an analysis of recorded data."



For example, say you create a monthly recurring work order to change an oil filter. This scheduled reminder is a good starting point if you are an SMB transitioning away from reactive maintenance.

However, a more advanced maintenance department may need value data metrics that illustrate how to fine-tune maintenance schedules beyond a manufacturer's recommendations. Organizations in this category should prioritize CMMS data collection software that simplifies complex metrics into user-friendly charts, graphs, and KPIs (e.g., MTBF, MTTR, and MTTF). Your reports should illustrate answers to questions like:

- How much time did Carl spend on safety audits last month?
- What percentage of our preventive maintenance tasks did we complete?
- Should we continue maintaining our HVAC or purchase a new one?
- Are we understaffed or overstaffed (and inefficient)?

Ideally, CMMS should cross-reference work order data by assigned technician, asset type, priority status, time to complete, and more to integrate into meaningful reports that support sound decision-making.

Know Your Projected ROI and Key Metrics

Before handing over your company credit card information, it is essential to calculate the expected ROI of your CMMS work order system. Of course, your boss will want to know: *How long will it take to get our money back?*

While it is impossible to have absolute certainty—with many unknown variables in the mix— you can make an educated guess using an ROI model.

Calculate CMMS Return on Investment (ROI)

The projected value of your CMMS investment is the total expected reduction in maintenance costs due to program implementation. You can calculate your ROI based on a *one-year, three-year,* or *five-year interval.* The formula is:

CMMS ROI = (CMMS Value – CMMS Cost)

CMMS Value is based on the following five categories of unnecessary costs:

1. Asset Life

Estimate the number of years the manufacturer expects asset life extension by executing preventive maintenance.

Translate the longevity improvement into a dollar amount by comparing it against a brand new asset's purchase prices.

Repeat the process for every organizational asset.

Add your assets' potential savings for a longevity grand total.

2. Downtime

Determine how often unscheduled downtime occurs per year.

Compare daily, weekly, and monthly revenue reports to determine how asset downtime affected revenue loss.

Calculate a total downtime loss for your chosen ROI parameter (e.g., one-year, three-years, or five-years.

3. Parts / Inventory

Estimate how much time your organization has lost responding to emergency purchase orders.

Estimate how much overstock inventory has cost your organization in terms of carrying costs and obsolete parts.

Add the numbers for a total parts/inventory value.

4. Labor Costs

Determine an average hourly labor amount wasted.

Estimate on average how much your organization spends on overtime hours and contract labor that can be avoided.

5. Utilities

Acquire your annual utility costs.

Compare the amount with the expected yearly costs, assuming your assets are operating at peak efficiency levels.

Once you have finished calculating your estimated value totals, it is time to evaluate your projected platform costs. *CMMS Costs* vary by user number total, feature package, and vendor. Modern platforms like MaintainX require zero to little training for mastery, while most legacy programs necessitate paid training modules.

Most MaintainX clients experience a first-year ROI ranging from 25 to 300 percent. Your results will vary depending on your organization's starting point, maintenance strategy, and consistent use of the CMMS.

04

Mean Time between Failures (MTBF)

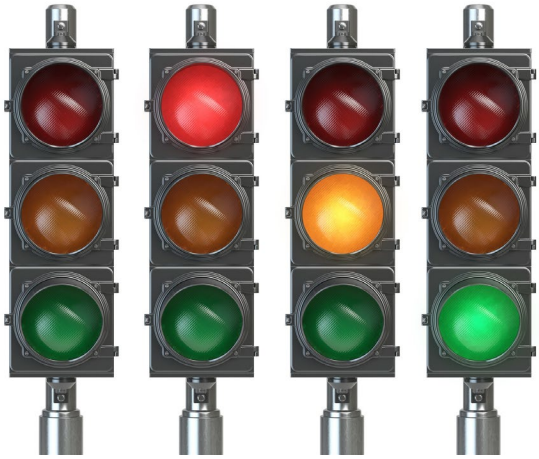
Mean Time between Failures (MTBF) is another useful KPI for leaders when considering equipment costs. MTBF equals the operation time between failures divided by the number of failures. In other words, if this metric is accurate, it can help inform capital allocation to increase efficiency across the operation.

MTBF = Production Time / Failures

For example, a production line unit (Asset A) may have been on for 2500 hours in a given year. In that year, however, the unit overheated and went down 12 times. Therefore, the MTBF for the line is a little over 208 hours. If, comparatively, the average MTBF of similar production line assets in the factory has an MTBF of 800 hours, you can quickly identify your outlier.

The higher the MTBF, the longer a system is likely to work before failing. If the MTTR is 2 hours, Asset A has caused 24 hours of downtime in your operation. If this production line yields $20,000 per hour, those 24 hours of unplanned downtime could amount to $480,000 of lost production output. If you factor in the cost to repair Asset A, both labor and parts, you may conclude that it makes sense to allocate budget to replace Asset A this year.

One of the best ways to decrease equipment failures is to implement a preventive maintenance schedule.



Preventive Maintenance Tips

Performing routine maintenance on manufacturing equipment may sound like a lofty goal in the midst of competing priorities. However, studies show that effective preventive maintenance programs can save companies money by reducing downtime. Predictive maintenance systems (that track machine historical data) can save even more.

Considering that 10 percent of industrial equipment ever completely wears out, and downtime costs some facilities as much as $22K a minute, practicing strategic preventive maintenance is wise. Increase your overall equipment effectiveness with planned maintenance.

Most facility and maintenance directors already understand the value of preventive maintenance. Many of them even invest in Computerized Maintenance Management Systems (CMMS) to digitize, assign, and organize work orders. The larger the manufacturing facility, the more difficult using paper clipboards becomes. Unfortunately, choosing the right CMMS platform can be tricky. According to Reliable Plant, an 80 percent of managers fail to use purchased CMMS solutions.

We believe this happens for a simple reason: The software is too complicated.

1. Choose a User-Friendly CMMS

Everyone on your maintenance team should be able to figure out how to create work orders, complete them, and track assets. Manufacturing preventive maintenance programs depend on the consistent use of CMMS platforms.

As mentioned by Jeff Owens, CEO of Advanced Technology Services, and Plant Engineering Maintenance Survey partner:

"It is clear, from my perspective and the majority of survey respondents, that the number one barrier to improved maintenance is the lack of staff resources, which lends itself to the need for experienced talent and technology providers."

Fortunately, new SaaS providers have entered the CMMS market, making the software more user-friendly than ever before. MaintainX offers a freemium maintenance management app that is comprehensive, elegant, and robust: Maintenance workers can learn how to access work order assignments, upload equipment photographs, chat with managers, and complete work orders in just a few minutes. The best part? They can do it from their smartphones.

Managers will also appreciate how MaintainX makes it easier to create repeatable work orders, cut equipment purchases, reduce equipment failure, streamline safety inspections, and ensure compliance with digital audit trails.

2. Track Costs for Savings Opportunities

Creating preventive maintenance schedules based on *your own* equipment, vendor, and worker data drives cost savings.

The best CMMS solutions cross-reference work order components by the assigned technician, asset type, priority status, time to complete, and several other categories. Combine this information to create powerful reports that illustrate previously unseen savings opportunities.

A user-friendly CMMS will make data collection a breeze so that maintenance does not feel burdened with cumbersome data entry steps. The more equipment data you have, the less likely your facility will experience downtime, and the faster it will meet customer deadlines.

3. Enhance Team Communication

One overlooked way to increase OTD is to strengthen communication between maintenance technicians and operators. How many times have your team members missed an important deadline or lost downtime because of a minor miscommunication?

While nothing beats face-to-face conversations, the enormous size of many manufacturing facilities means that it is not always convenient. Conversations are often limited to walkie-talkies, email, and text messages–if they happen at all. However, these methods are not helpful when trying to organize complex instructions regarding separate projects. The most efficient way to communicate effectively is via business messaging platforms.

Software companies like Slack, Lua, and HipChat provide smartphone apps that allow companies to organize communication threads by department, project, and tasks. The MaintainX platform takes things a step further. Our CMMS allows manufacturing team members to upload PDFs, take equipment photos, and chat directly within the comments section of digital work orders.

When you receive last-minute instructions about ordering parts, simply update the information within the work order and ping the assigned technician with a comment. Containing important discussions within respective work order categories helps manufacturing teams decrease the likelihood of equipment setbacks, downtime, and shipment delays.

4. Negotiate Preventive Maintenance Arrangements with Equipment Providers

Many machinery manufacturers offer preventive maintenance service visits for flat annual rates or discounted labor costs. If an equipment provider does not offer such agreements, make sure you receive recommended PM instructions for your team to work with.

Not only do service contracts ensure necessary PM is performed, but they also help managers improve their cases for annual budgets. While you should strive to complete most maintenance in-house, partnering with an experienced equipment service provider on important assets can be beneficial.

5. Shadow Equipment Providers

Anytime an outside technician visits, consider assigning an in-house technician to shadow his work. This is an excellent time for maintenance team members to observe complex maintenance tasks up-close, ask questions, and take notes. The shadowing worker should also request a copy of the inspection report to record the parts checked and the date of service in your asset history and CMMS calendar.

The next time that specific machine is due for preventive maintenance, your in-house technician should feel confident enough to take on the task. Taking advantage of every training opportunity is key to establishing an effective manufacturing preventive maintenance program.

6. Stock Frequently Replaced Parts

Next, consider asking outsourced providers for spare parts lists. You should be able to purchase your equipment's most frequently needed parts at a cheaper price. While you should not feel obligated to buy every part, stocking the most commonly replaced parts can reduce potential downtime and save money in the end.

7. Plan PM Based on Seasonal Variables

Finally, schedule preventive maintenance tasks that require downtime during slower seasons. Comprehensive PM for larger assets requires an average of four to eight hours for completion. Get ready for a marathon maintenance session! However, these preventive measures can help your team avoid days' worth of reactive maintenance when a critical machine breaks down and causes costly downtime.

Maintenance teams that choose user-friendly CMMS solutions to support preventive maintenance programs can reduce downtime, increase OTD, and increase organizational profits. In-house technicians that take the time to shadow outsourced equipment service providers also contribute to facility efficiency.

05

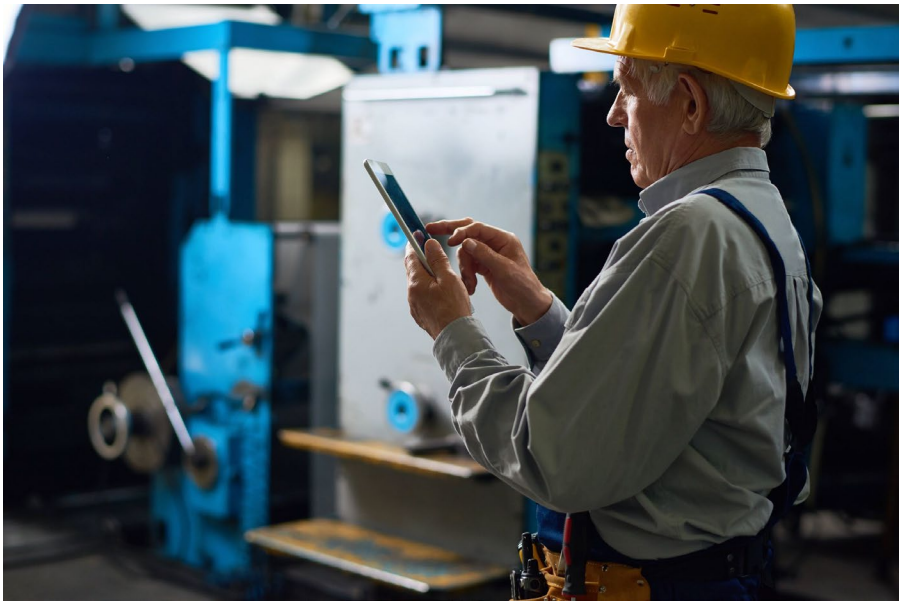
Preventive Maintenance (PM) Compliance

Preventive Maintenance (PM) Compliance indicates how many scheduled PM tasks technicians completed within a specific timeframe. This KPI is essential to measuring the effectiveness of PM scheduling.

A PM schedule lays out when maintenance activities are to be performed on a given piece of equipment. When developing your PM schedule, select a day and time for maintenance that does not disrupt production. Base PM schedules on one of two metrics:

Time: You can base your PM schedule on time and perform maintenance after a set period of time. For example, your fleet of vehicles can undergo maintenance every three months.

Usage: For usage-based PM schedules, track usage metrics such as operating hours and production cycles. Technicians then perform maintenance activities as specific metrics are met. For example, schedule your fleet of vehicles for maintenance every 1,000 miles instead of every three months.



PM schedules usually depend on a work order system. A work order is a document that provides details about a maintenance task and outlines the process to complete the task.

It details the scope of the work, what is expected, the expected timeline for completing the job, who authorized the work orders, and an assigned maintenance technician. Work orders help you organize, assign, prioritize, track, and complete maintenance tasks besides capturing asset maintenance history.

Studies suggest one hour of downtime costs industrial manufacturers between $10,000 and $250,000. Purely reactive maintenance programs are expensive, stressful, and time-consuming. This is why best-in-class maintenance departments aim to achieve an ideal ratio of 80:20 preventive maintenance (PM) to reactive maintenance. Strategic preventive maintenance programs reduce unplanned downtime, increase operational efficiency, and reduce maintenance expenses associated with unplanned repairs.

Launching a successful preventive maintenance program from scratch involves several steps, including taking asset inventories, conducting criticality analysis, and determining key performance indicators (KPIs) to measure success. In this article, we will walk through the highlights with an emphasis on creating preventive maintenance schedules for your organization.

What Is a Preventive Maintenance Schedule?

A **preventive maintenance schedule** is a plan for organizing company resources to ensure maintenance tasks are performed according to specific time or usage triggers. The primary goal of preventive maintenance is to keep assets in optimal working condition.

Creating a preventive maintenance schedule involves coordinating materials, equipment, and timeframes for completing tasks. It also entails determining who should perform which tasks and how they should do it. Dedicated maintenance schedulers, maintenance supervisors, and maintenance planners are the team members most often responsible for developing PM schedules.

With that said, do not confuse *maintenance scheduling* with *maintenance planning.* Though the two processes support each other, the same individual does not usually complete the two processes. Maintenance planning focuses on **what** needs to be done and **how.** Maintenance scheduling, on the other hand, details **who** will perform recommended maintenance tasks and **when.**

Fixed vs. Floating Preventive Maintenance Schedules

Effective preventive maintenance schedules help facility managers efficiently allocate maintenance resources, effectively maintain assets, and appropriately plan for the year ahead. When making a preventive maintenance schedule, you have two primary options: fixed and floating PM scheduling.

1. Fixed PM Schedules

A *fixed preventive maintenance schedule* is a routine maintenance plan scheduled according to specific equipment usage or time interval. Fixed PM schedules focus on future planned tasks, regardless of whether previous tasks were completed or not. For instance, tasks scheduled on Mondays are always performed on Mondays regardless of whether your technician completed last week's assigned task. Maintenance schedulers may also base recurring PMs on specific usage intervals or triggers.

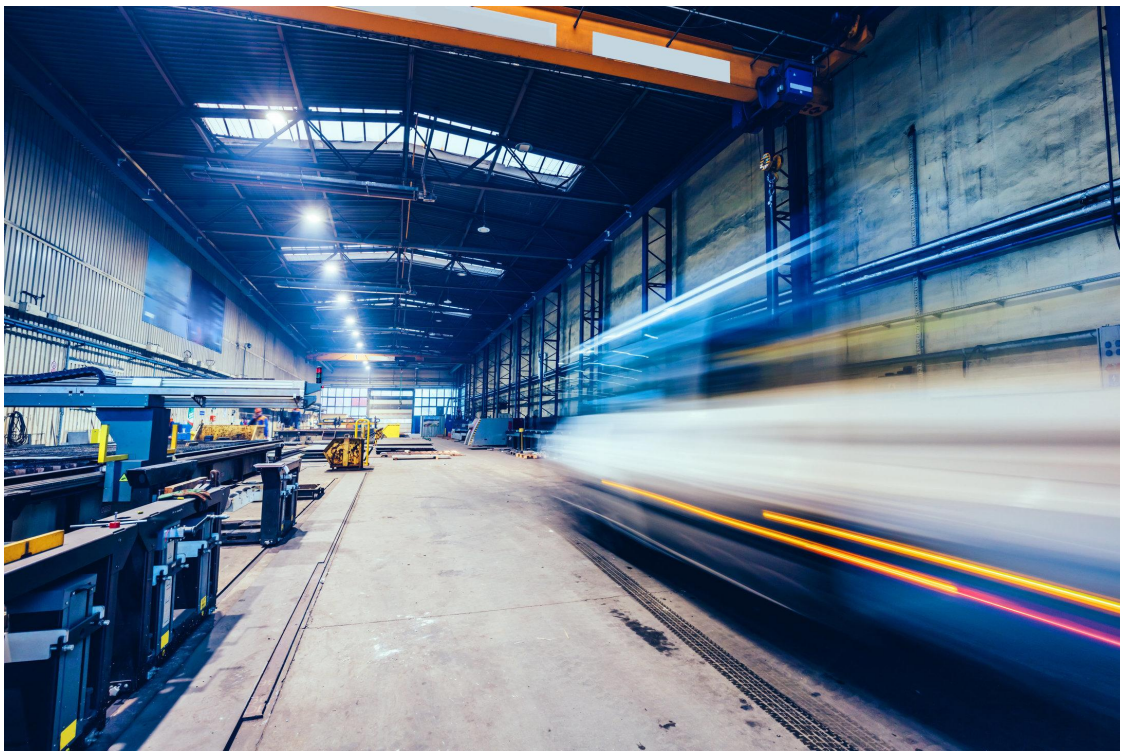
EX: You schedule your fleet's vehicles to undergo maintenance every 3,000 miles. Once an odometer reaches 3,000, you create a work order for a routine oil change and performance check. The vehicle's next oil change will happen in another 3,000 miles. It does not matter how long it takes your driver to reach the mileage. This is a fixed PM schedule based on usage intervals.

2. Floating PM Schedules

A floating preventive maintenance schedule is a maintenance plan based on the timing of previous PM tasks. Floating PM schedules are informed by an asset's past usage or maintenance history.

For instance, assume you have a 30-day PM schedule for a machine. You will assign the asset's next PM 30 days from the completion of the last PM activity. In other words, the subsequent work order will not be triggered until the previous work order has been completed and closed. Floating PM schedules require greater diligence than fixed PM schedules for tracking maintenance task completion.

EX: You schedule an HVAC system for maintenance every 100 hours of operation. You delay maintenance until after the 120th hour. Therefore, your next work order will be triggered after 220 hours from the original PM. The system starts counting the 100 hours after the technician closes the previous work order (at the 120th hour). If the HVAC system were on a fixed schedule, it would still be triggered for maintenance after 200 hours.



How to Create (and Implement) a Preventive Maintenance Schedule

The key to creating a successful preventive maintenance schedule is identifying the right maintenance interval for each asset. This allows you to maximize resources while reducing the chance of unexpected breakdowns.

To create an effective preventive maintenance schedule, follow these steps:

1. Inventory Assets

Create an inventory of your organization's most crucial assets. These are the pieces of equipment that should receive preventive maintenance first. This exercise will help you avoid delaying maintenance for specific assets, especially if using a floating PM schedule.

Record the following data for each asset:

- Make and model
- Serial number
- Specifications and capabilities
- Unit number
- Category
- Location
- Primary users
- Parts

You can use a spreadsheet or a computerized maintenance management system (CMMS) to catalog your asset entries. We recommend adopting a user-friendly platform like MaintainX to maintain asset records, cross-reference data, and glean cost-saving insights over time.

2. Determine Priorities

Remember, most of your facility's assets do not need to be scheduled for preventive maintenance. Exclusively performing PM on large asset inventories is unrealistic for most organizations. Additionally, performing PM on inexpensive, non-critical, and easily repaired items is wasteful. One way to determine PM priorities is to conduct a criticality analysis.

A **criticality analysis** is an exercise that involves ranking assets according to their risk potential in several categories, including operational, financial, environmental, and

health and safety. This process is beneficial to organizations with several complex assets because it removes personal bias from the equation.

Criticality analyses allow managers to rank, prioritize, and schedule PMs with objectivity. Assets with higher criticality ratings should receive top priority. **Use the following questions as a launchpad when evaluating asset criticality:**

- Which assets are critical to production and safety?
- Which assets require regular maintenance?
- Which assets have high repair and replacement costs?

Prioritize assets critical to production, require regular maintenance, or have high repair and replacement costs when making your preventive maintenance schedule. Remember: it is more cost-efficient to place non-critical and older assets on reactive maintenance programs. You might be replacing them soon, after all.

3. Identify Ideal PM Intervals

Of course, preventive maintenance is not without a potential downside. Without proper planning, you risk wasting precious resources on unnecessary inspections and repairs. Over-maintaining assets can be just as wasteful as under-maintaining them! Avoid overdoing it by identifying ideal PM ratios for your individual assets.

The three primary methods to determine PM intervals include:

- Consulting equipment manufacturer's manuals for recommended maintenance work instructions, schedules, and usage of critical spare parts
- Reviewing historical maintenance data for insights into past failure patterns
- Asking machine operators and technicians for their insights into asset behaviors

4. Schedule Recurring Work Orders

According to the 2019 Plant Engineering Maintenance Survey, **45 and 39 percent of facilities still rely on in-house spreadsheets and paper records,** respectively, for maintenance scheduling.

Little do these organizations know just how much easier *the right* CMMS can make their maintenance scheduling. Modern, cloud-based CMMS platforms are scalable, affordable, and user-friendly. The software allows you to automate both long-term maintenance schedules and short-term schedules based on quarterly, monthly, weekly, and daily tasks.

CMMS also allows you to capture minor maintenance activities that often fall through the cracks and go unnoticed. This enables teams to maintain backlogs at manageable

levels. Additional features like inventory management, asset cross-referencing, work order commenting, team chat, and advanced reporting make MaintainX a game-changing tool for maintenance teams of all sizes.

5. Monitor Progress

Lastly, periodically monitor the progress of your maintenance schedules and identify areas for improvement. Most importantly, evaluate how many PMs your team has completed since creating your initial maintenance schedules. Additionally, several metrics are available to track the progress of your PM program, including:

Mean Time between Failure (MTBF): MTBF is the average time between asset breakdowns. Use MTBF to measure the performance, design, and safety of critical assets.

MTBF = # of operational hours / # of failures

Planned Maintenance Percentage (PMP): PMP measures how many scheduled maintenance activities have been completed compared to your overall number of maintenance tasks. Use PMP to measure the effectiveness of your PM scheduling and identify opportunities to minimize reactive maintenance.

Scheduled Maintenance Critical Percent (SMCP): This metric measures how late a recurring maintenance activity is in relation to how often it should be performed and completed. SMCP helps determine overdue maintenance activities ripe for prioritization. The formula to calculate SMCP is: *(number of days a task is overdue + length of the maintenance cycle) ÷ length of the maintenance cycle * 100*.

Preventive Maintenance Compliance (PMC): This metric measures how many scheduled tasks have been completed within a given period. It is also useful for determining PM schedule effectiveness.

PMC = # of completed PMs / # of scheduled PMs * 100

Overall Equipment Effectiveness (OEE): OEE measures the level of productivity for an asset. It combines asset availability, performance, and production quality to determine the efficiency of an asset in production. An asset with an OEE of 100 percent does not experience any unplanned downtimes (availability), produces as fast as possible (performance), and does not have any defects (quality).

Use the metrics that most closely align with your O&M goals as benchmarks of success.

Final Tips for PM Scheduling Success

Preventive maintenance scheduling is not rocket science. However, several challenges can disrupt workflows, reduce schedule compliance, and create bottlenecks if not proactively navigated. Some common factors that disrupt PM schedules are:

- Poor team communication
- Inefficient maintenance inventory management
- Misunderstandings with third-party contractors
- Miscommunication with suppliers
- Lack of in-house skills for specialized tasks

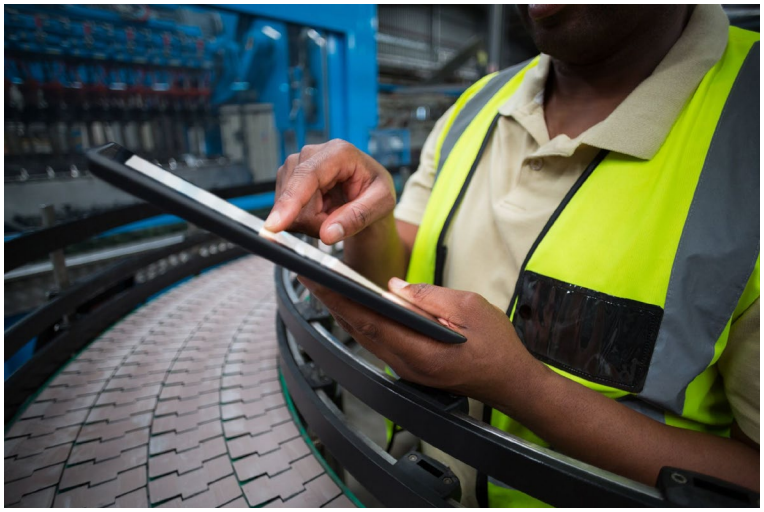
Taking the time to develop centralized communication systems, employee continuing education programs, and clear standard operating procedures (SOPs) will set your team up for success. An effective preventive maintenance schedule will help improve the lifespan of critical assets, minimize operating costs, and significantly improve overall maintenance operations.

06

Maintenance Backlog and Scheduled Maintenance Critical Percent (SMCP)

The KPI Maintenance Backlog refers to quantifying the number of prioritized tasks not completed by the specified deadline. The duration of each work order is defined as the difference between the current date and the “required by date.” All work that does not have an “ordered by” date is usually included in the backlog. Typically, the backlog is measured in “crew-weeks,” which are the total number of labor hours represented by the work on the backlog, divided by the number of labor hours available to be worked in an average week by the work crew responsible for completing this work. For this reason, the backlog is one of the most important Key Performance Indicators (KPI) used in maintenance.

Crucial to reducing maintenance backlogs is expert and efficient scheduled maintenance. Scheduled maintenance refers to maintenance tasks that are assigned to a technician with a given deadline. It includes inspections, servicing, adjustments, and planned shutdowns. Technicians can perform the tasks as one-off jobs or at regular intervals. Scheduled maintenance aims to minimize equipment failure, maintenance backlogs, and reactive maintenance. It also allows for better resource allocation. For instance, changing the bearing on a conveyor belt every 30 days to prevent its snapping is an example of scheduled maintenance. Another example is scheduling the repair of a motor after noticing a problem.



Scheduled Maintenance and Preventive Maintenance

Scheduled maintenance is often confused with preventive or planned maintenance. However, there are at least two differences:

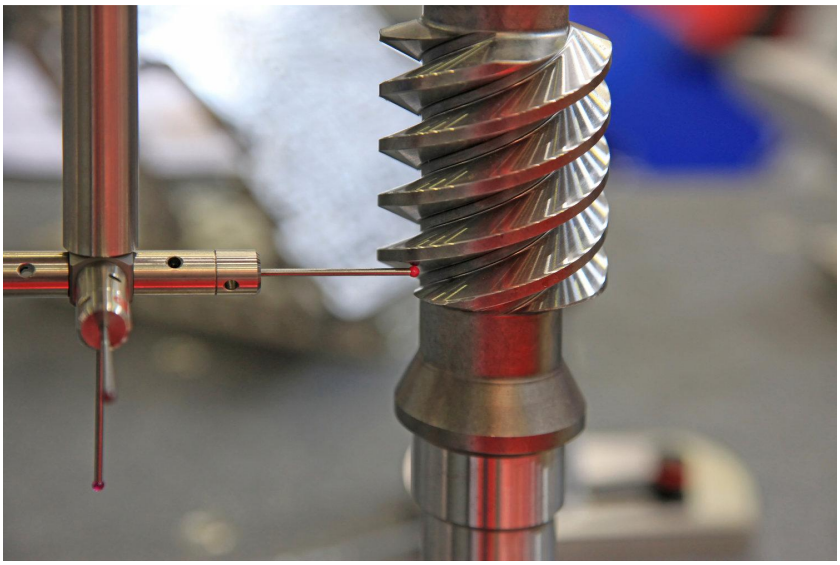
Planned maintenance involves anticipating equipment needs and implementing strategic systems for completing future maintenance actions. This process includes identifying a task, organizing materials and workflows, prioritizing work orders, and implementing procedures to analyze the ongoing effectiveness of completed tasks. Planned maintenance includes correction-based (CBM), predictive, and preventive maintenance.

Scheduled maintenance refers to deciding when maintenance tasks will be completed and by whom. Unlike planned maintenance, scheduled maintenance does not require complex work and equipment behavior forecasting. A task falls into this category when an issue has been identified, assigned to a technician, and given a deadline for completion. It can either be part of a comprehensive planned maintenance strategy or a simple workflow on its own.

How Important Is Scheduled Maintenance?

Although scheduled maintenance is a simplistic form of preventive maintenance, the practice is still valuable. It ensures equipment will continue working as designed to reduce downtime and maintain maximum value. Depending on the asset condition and manufacturer specifications, consistent maintenance schedules can add years to asset lifespans. Furthermore, minimum recommended maintenance instructions keep asset warranties active.

If you intend to sell off an asset as salvage, or acquire a new one, performing routine maintenance will help retain its resale value. For this reason, it is always advisable to document time-based maintenance and equipment servicing. Most obviously, the type of maintenance is a useful tool for asset diagnostics. Your maintenance team may rely on your schedule to ensure assets function as they should and resolve any issues before a breakdown occurs.



Factory Scheduled Maintenance

Factory scheduled maintenance is a form of time-based maintenance with a focus on checking for signs of problems, while doing maintenance procedures to improve performance. Also known as 30/60/90K maintenance in the automotive world, the term refers to vehicles undergoing owner's manual procedures every 30,000 miles. However, all types of machinery come with recommended intervals for maintenance schedules that ensure optimal functioning.

Many companies avoid factory-scheduled maintenance to save money. However, doing so proves costly in the end. As previously mentioned, failing to follow recommended maintenance schedules can null warranties. You may also suffer unexpected equipment breakdowns leading to expensive downtimes.

Scheduled Maintenance Critical Percent (SMCP)

Scheduled maintenance critical percent (SMCP) is a tool used by companies to organize recurring planned maintenance tasks and prioritize overdue maintenance tasks. The tool calculates how late your maintenance tasks are in relation to their frequency of occurrence. Tasks with higher percentages are given priority.

So, why is SMCP needed? Ideally, it is performed on the exact manufacturer's recommended scheduled day, and everything works out perfectly. However, as any seasoned technician will agree, things do not always work out as planned on paper.

How to Calculate SMCP

SMCP is calculated by adding the number of days scheduled maintenance is late to the number of days in a maintenance cycle. Divide your result by the number of days in the maintenance cycle and multiply that number by 100 to arrive at a percentage.

SCMP Formula:

SMCP = (# days late + # days in cycle) / # days in cycle * 100

Example:

Two scheduled maintenance tasks on the same system are overdue. The first task, typically completed every 30 days, is 3 days overdue. The second task, which is performed every 90 days, is five days late. So, which task should your maintenance team tackle first?

Task 1: (3+30) / 30 * 100 = 110%

Task 2: (5+90) / 90 * 100 = 105%

According to SMCP, Task 1 has the higher percentage and, therefore, you should prioritize it.

Benefits of Tracking SMCP

Calculating SMCP benefits organizations in three ways:

- **Improves Maintenance Scheduling:** SMCP allows you to know which tasks to prioritize for improved effectiveness.
- **Reduces Cases of Reactive Maintenance:** The formula also allows you to identify assets that are more prone to failure and take care of them. You can clear your backlog in order of priority.
- **Makes Audits Easier:** Missed maintenance schedules can cause trouble with audits and compliance. Tracking your SMCP enables you to highlight urgent tasks and take care of them before they cause problems. It also helps to identify the root cause of overdue tasks for addressing.

Finally, SMCP helps to reduce unnecessary downtimes and maintenance costs. It is a foundational maintenance metric that can help to elevate your maintenance strategies.

How to Write Scheduled Maintenance Messages

The key to a well-run program is clear and timely communication between facilities managers, maintenance technicians, and key stakeholders. Here are a few tips on how to write work order announcements that are read, understood, and remembered:

- **Understand Task Impact:** The scope of the impact of the maintenance task will inform your strategy. Which service lines and how many users will be affected? How long will the task last? Put yourself in the user's shoes and think about how the interruptions will affect them.
- **Give Sufficient Notice:** Do not ambush users with news of a scheduled maintenance task. Inform everyone early enough and give constant reminders until the day of the task. See an example of a reminder below.
- **Use Effective Communication Channels:** For company communications, emails are most effective. For other users, you can rely on social media posts and in-app banners.
- **Include Necessary Details: There is no need to list all of the details, but** inform your users which team is doing the maintenance, channels through which their concerns and questions will be addressed, and alternative ways to access your services if there are any.

Conclusion

A robust scheduled maintenance program can help companies prioritize maintenance tasks, minimize equipment failure, and reduce maintenance backlogs while allowing for better resource allocation. It will also reduce the need for costly reactive maintenance repairs. The easiest way to create work orders, assign scheduled maintenance, and track progress is with the use of a mobile-based Computerized Maintenance Management System (CMMS).

07

Mean Time to Repair (MTTR)

Mean Time to Repair (MTTR) refers to the average time maintenance teams spend diagnosing, repairing, and recovering failed pieces of equipment. MTTR is a baseline that maintenance departments use to improve asset efficiency, minimize unplanned downtimes, boost bottom lines, and assess equipment value.

Mean Time to Repair (MTTR) provides a useful productivity benchmark for organizations seeking to reduce prolonged repair times and their associated expenses.

Conducting an MTTR analysis allows organizations to evaluate the quality and effectiveness of their maintenance strategies, processes, and practices. For many industries, organizational effectiveness is dependent on asset reliability. Critical equipment breakdowns often translate to extended repair times, technician overtime, outsourced contractor fees, and lost production schedules.

Maintenance experts recommend striving for **an ideal MTTR below 5 hours.** However, the metric can vary substantially based on asset type and importance, for example. Well-informed department leaders routinely monitor MTTR for both individual pieces of equipment and the organization as a whole.

The metric provides insights into maintenance scheduling, replacement parts purchases, and maintenance task completion. Ultimately, delving deeper into "the whys" behind extensive MTTR metrics helps maintenance teams increase uptime, enhance efficiency, and decrease unnecessary costs. MTTR includes the time taken to:

- Notify maintenance technicians of a failure
- Diagnose the cause of the failure
- Fix the problem at hand
- Wait for overheated equipment to cool down
- Reassemble, align, and calibrate equipment
- Set up, test, and restart equipment for average production targets

It is worth mentioning that hunting down replacement parts can significantly impact MTTR? Lack of inventory optimization leads to out-of-stock parts, expedited shipping costs, and serious maintenance delays.

How to Use MTTR

MTTR is a powerful tool for predicting the impact of equipment failure on an organization's bottom line. The higher the MTTR, the costlier the downtime.

Applications of MTTR include:

- **Maintenance Decision-Making:** MTTR can help leaders make decisions about whether to repair or replace aging assets. Considering that up to 40 percent of unplanned downtime is due to aging equipment, MTTR indicates how long it takes to repair an asset as it ages. In such cases, it can be more economical to replace an asset than to fix it. Furthermore, MTTR can predict the lifecycle costs of a new system to inform its purchasing and design process.
- **Preventive Maintenance Scheduling:** Tracking MTTR helps organizations ensure that their preventive maintenance (PM) programs and activities are efficient and effective. MTTR primarily measures reactive maintenance, but it can help determine how to schedule maintenance activities to minimize unplanned breakdowns. For example, longer MTTR may mean that PM activities are not standardized and optimized for maximum efficiency.

- **Maintenance Planning and Inventory Purchasing:** Disorganized management of replacement parts can significantly impact asset maintenance. It leads to delayed completion of maintenance activities. According to Chemical Processing, the lack of replacement parts causes about 50 percent of unplanned downtimes. Additionally, organizations spend up to 25 percent of maintenance time sourcing for replacement parts. Ensuring that replacement parts are not defective, understocked, or mislabeled can reduce MTTR. Forecasting maintenance needs allows organizations to stock necessary replacement parts for upcoming activities, including reactive maintenance.

While machine failure is inevitable, MTTR helps organizations quickly and efficiently respond to equipment breakdowns. This strategic key performance indicator can help minimize disruption to production, revenue loss, and customer dissatisfaction by establishing a baseline for improvement.

How to Calculate MTTR

Calculate Mean Time to Repair (MTTR) by tracking the total amount of time an asset undergoes recovery after downtime, then dividing by the number of times the asset in question has failed within a given time. MTTR formula:

MTTR = Total downtime / Total # of failures

For example, if an organization spends **50 hours total on unplanned maintenance** for an asset that **broke down eight times** in one year, the asset's **MTTR is 6.25 hours**. Notably, MTTR does not depend on an asset's uptime. It only factors in how long each unplanned stoppage lasts. The MTTR formula assumes that well-trained maintenance personnel perform all maintenance tasks sequentially.

How to Improve MTTR

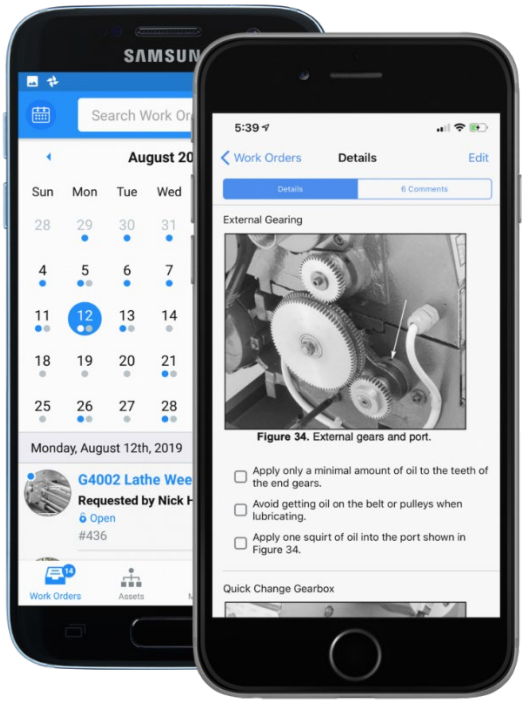
The first step to improving MTTR is to understand the four stages of MTTR: *problem identification, diagnosis, repair, and verification* that the asset is operational again. The primary goal is to reduce the time spent in each stage. Of course, preventive maintenance is crucial to reducing significant equipment breakdowns. However, asset data collection, analysis, and problem solving is what ultimately reduces MTTR.

The most important ways to reduce MTTR include:

- Anticipating breakdowns and organizing resources needed for corrective maintenance
- Providing maintenance personnel and third-party contractors with detailed standard operating procedures to avoid miscommunication while performing tasks
- Ensuring that maintenance personnel are adequately trained and equipped with the necessary skill sets
- Leveraging technology, such as computerized maintenance management systems (CMMS), to streamline maintenance activities
- Implementing well-managed spare parts and tools inventory system

Conclusion

MTTR is one of several metrics that operational managers use to track time spent on equipment failure and repairs. Lower MTTR translates to less downtime, reduced maintenance costs, stable production, and improved customer satisfaction.
A Computerized Maintenance Management System (CMMS) platform is the easiest way to collect, store, and analyze MTTR.



08

Overall Equipment Effectiveness (OEE)

Overall Equipment Effectiveness (OEE) is a manufacturing standard used to measure the productivity of facilities, processes, and equipment. OEE indicates how efficiently organizations manage the production process by calculating asset availability, asset performance, and product quality.

Successful manufacturing plants consistently monitor several critical equipment parameters that contribute to operational performance. Overall Equipment Effectiveness (OEE) is one such metric that helps organizations identify the percentage of productive manufacturing time.

OEE helps operational managers identify underlying losses, eliminate waste, benchmark progress, and improve manufacturing processes. Notably, Seiichi Nakajima, pioneer of Total Productive Maintenance (TPM), established the metric in the 1980s.

Factors of Overall Equipment Effectiveness

Three primary factors drive manufacturing plant performance: product quality, availability, and performance efficiency. Organizations striving to achieve world-class OEE ratings should aim to score the following percentages within each category:

- **Product Quality:** Rating of at least 99 percent. Quality takes into account defects and includes parts that need reworking. A rating of 100 percent means that the facility never produces defects.
- **Availability:** Rating of at least 90 percent. Availability factors in both planned and unplanned downtime during production. A 100 percent score means a facility experiences no downtime during production.
- **Performance Efficiency:** Rating of at least 95 percent. For performance, small stops and slow cycles should be taken into account. Processes that run without any stops or slow cycles have a 100 percent score.

For example, a facility with a 100 percent OEE score always produces high-quality products with zero downtime. Alternatively, a facility with a 60 percent OEE score fails to meet quality standards 40 percent of the time.

Benchmarks for Overall Equipment Effectiveness

Besides being used as a baseline to track progress and eliminate production waste, OEE is also a benchmark for comparing the performance of given assets to other similar organization assets, industry standards, and/or the results of different shifts for the same asset.

The benchmarks for OEE are:

- **100 Percent:** Production is perfect, and the facility is only producing quality goods as fast as possible without any downtimes.
- **85 Percent:** This is a world-class rating for discrete manufacturers that produce itemized products such as automobiles, furniture, toys, and smartphones. Most organizations strive to achieve an 85 percent OEE rating in the long term.
- **60 Percent:** This is a fair rating for discrete manufacturers. However, they are always aiming to improve this mediocre rating.
- **40 Percent:** This is a low rating and is common for manufacturers still improving their performance. Minimizing downtime can improve the rating.

Ideally, maintenance experts recommend that organizations maintain a minimum OEE rating of 77 percent.

OEE Benefits

Implementing an OEE strategy can help organizations to achieve their production targets. It gives them the flexibility to proactively tweak their processes in real-time and reduce downtimes and costs while improving production capacity, quality, and efficiency. The benefits of OEE include:

- Better return on investment (ROI) for assets
- Increases competitiveness with minimized production losses
- Reduces maintenance costs with minimized unplanned downtime
- Maximizes employee productivity by allocating resources appropriately
- Enables organizations to visualize their performance and note areas to improve based on production data

When correctly implemented, OEE provides organizations with a deep understanding of their production processes. This information helps companies improve production and stay competitive within their industries. They also can maximize their ROI from assets critical to production.

How to Calculate Overall Equipment Effectiveness (OEE)

The formula for calculating OEE is:

OEE = Availability * Performance * Quality

Begin by defining and quantifying your three primary factors:

- **Availability:** Calculate availability by dividing the actual hours of operation by the full working shift. For instance, an asset that has an hour of planned downtime operates for a total of 7 hours in an 8-hour working shift. To calculate the asset's availability, the organization divides 7 by 8 hours. Availability equals 87.5 percent.
- **Performance Efficiency:** Calculate performance efficiency by multiplying the number of processed units by the ideal cycle time for each unit and then dividing by the actual operation time. For instance, a facility that produces 440 units with a 0.5 minutes ideal cycle time for each unit in 420 minutes (actual operation time) has a performance efficiency rating of 52.38 percent.
- **Rate of Quality Products:** This quantifies how many of the units produced meet the required quality standards. For example, if only 435 products out of 440 units produced are of acceptable quality, then the rate of quality products is 97.73 percent.

Once you have your three figures, multiply them to calculate your Overall Equipment Effectiveness percentage.

The aforementioned organization would have an OEE rating of 44.79 percent—that is, 87.5 percent * 52.38 percent * 97.73 percent.

How to Improve OEE

Organizations should always strive to improve their OEE rating. They can do this by reducing inefficiencies and losses in their processes. These six big losses affect OEE:

- Equipment failures
- Equipment setups and adjustments
- Minor production interruptions (small stops)
- Reduced production speeds
- Defective products
- Rejects on startup

The first two losses affect availability, while the next two impact performance. The last two affect quality. Identifying and minimizing these losses will improve an organization's overall OEE.

Conclusion

Overall Equipment Effectiveness (OEE) is a key metric for organizations to measure production effectiveness and efficiency. The metric identifies underperforming assets and connects poor performance to availability, performance, and/or quality issues. This information provides useful insights for planning, scheduling, and conducting maintenance activities. In the end, OEE helps optimize maintenance strategies and reduce costs.

09

Equipment Downtime

Equipment downtime is the amount of time production stalls due to a non-functioning piece of machinery. According to *Industry Week*, the manufacturing industry loses about $50 billion each year to unplanned breakdowns. Downtime also can be the result of corrective maintenance, emergency maintenance, or preventive maintenance.

The Cost of Equipment Downtime

Unfortunately, machine failures affect critical business functions and limit profitability. Some of the costs an organization may incur because of equipment downtime include:

- **Detection Costs:** These are costs incurred to investigate the root cause of equipment downtime. An organization spends resources and dedicates its personnel to identify and diagnose the issue correctly.
- **Containment Costs:** Containment costs are expenses spent minimizing the downtime's impact and preventing the failed asset from affecting other pieces of equipment. It also includes fees for temporary fixes.
- **Recovery Costs:** These are costs spent on restoring baseline operations after a downtime. For example, locating and installing backup systems for data recovery.
- **Ex-post Response Costs:** After equipment downtime, an organization incurs incidental expenses resulting from production disruption and recovery. Costs include legal costs and penalties from regulatory authorities.
- **Equipment Costs:** These are repair and replacement costs for the affected piece of equipment. It includes the cost of purchasing replacement parts and delivery to the location. Expenses to fix other assets damaged by downtime also fall into this category.
- **Lost Revenue:** This is the total revenue an organization loses because of downtime. It includes disruption to production, incomplete customer purchases, and collapsed sales contracts.
- **IT Productivity Loss:** These costs include financial loss suffered due to an IT team's inability to perform its duties and overtime payment used for resolution.

- **User Productivity Loss:** Similar to IT productivity costs, but includes the cost of labor when employees are unable to perform their duties due to the downtime. It also includes overtime compensation.
- **Third-Party Costs:** These are expenses that the organization pays to consultants, asset specialists, and contractors to resolve the issue. It can also include the costs of a PR firm to manage a possible fallout with stakeholders.
- **Business Disruption:** This refers to the overall cost of the downtime, including lost revenue, lost productivity, missed production deadlines, recovery costs, reputational damage, customer churn, and other long-term damages to the organization.

Unexpected equipment downtime causes interruptions to business process flow, damages assets, and results in massive losses. It also forces maintenance personnel to divert their focus from preventive maintenance activities to reactive maintenance. Reactive maintenance is often more expensive than proactive maintenance.

How to Track the Cost of Equipment Downtime

Calculate the total amount of revenue from the sale of products made during the equipment breakdown. Here's an example:

- Company X produces 10 units an hour that sell for $50 apiece.
- The machine used for making the products breaks down for 4 hours.
- The company will have lost $2,000 in profits during downtime.

Of course, the example does not show the indirect costs of downtime. It is possible that Company X also had to put extra capital toward the expedited shipping of parts, outsourced expertise, or overtime pay to mitigate the problem. Depending on the size of the organization, and the frequency of downtime, each of these extraneous costs adds up to sizable reductions in profit margins.

Benefits of Tracking Downtime

Tracking equipment downtime allows operational managers to develop proactive maintenance strategies. Practicing preventive maintenance (PM) on critical assets means technicians correct minor parts issues before they cause total breakdowns.

Benefits of tracking equipment downtime include:

- Enabling maintenance teams to focus on proactive maintenance due to minimal unplanned downtimes;
- Giving maintenance managers useful insights to prioritize work orders;
- Encouraging the accurate implementation of corrective maintenance activities;
- Supporting higher equipment uptime, reliability, and efficiency; and
- Minimizing unnecessary costs.

Industry experts suggest striving to maintain equipment at 90 percent availability with less than 10 percent downtime. However, do not expect to get there overnight. Switching from reactive to proactive maintenance mode requires consistent asset historical data analysis, adequate staffing, and a commitment to following a strategic preventive maintenance program.

How to Manage Equipment Downtime

Company leaders cannot afford to overlook the impact of equipment downtime on organization profitability. Organizations must learn to manage downtime to control operational costs and maximize efficiency by:

- **Anticipating the impact of downtime on the business:** Even for planned downtimes, schedule maintenance activities with minimal disruption to production. It is advisable to schedule activities during off-hours. Scheduling maintenance also helps to organize resources for temporary fixes.
- **Tracking an asset's useful life cycle:** Knowing when a machine will reach the end of its useful life cycle helps to prevent unplanned breakdowns.
- **Using advanced technology:** Technology such as computerized maintenance management systems (CMMS) helps an organization monitor asset performance and predict when failure is likely to occur. It enables an organization to take a proactive approach to maintenance and minimize unexpected downtimes. CMMS software can track probable causes of equipment downtimes and enable maintenance managers to make effective decisions. Additionally, such technology helps to inform where the organization should direct its maintenance efforts.

Conclusion

Organizations lose massive amounts of revenue due to equipment downtime. While it is impossible to eliminate downtime, companies should do everything they can to minimize such occurrences. To reduce equipment downtime, organizations need to invest in robust CMMS software, document their maintenance efforts, and implement proactive maintenance programs. Tracking downtime is essential because it determines how an organization uses its maintenance resources. Tracking equipment downtime saves money and time by directing resources to the right maintenance activities.

10
Planned Maintenance Percentage (PMP)

Planned Maintenance Percentage (PMP) represents the amount of maintenance time used for scheduled maintenance activities, calculated against the cumulative number of maintenance hours for a given time period (e.g. weeks, months, years).

How to Calculate Planned Maintenance Percentage

PMP = # of planned maintenance hours / # of total maintenance hours * 100

Planned maintenance is a maintenance approach focused on minimizing equipment downtime and returning to uptime as soon as possible after a breakdown. It is a basic form of preventive maintenance carried out “according to plan.” Planned maintenance involves knowing ahead of time the spare parts, tools, services, and maintenance tasks needed to solve a problem.

Dealing with unplanned breakdowns that cause operations to grind to a halt is stressful, expensive, and time-consuming. For this reason, facilities often plan, document, and schedule their maintenance activities. Every asset wears out at some point. However, leaders can keep equipment efficiently running as long as possible with planned maintenance. The easiest way to execute effective scheduled maintenance work is with the help of a Computerized Maintenance Management System (CMMS).

However, a 44 percent of organizations still rely on paper records to plan their maintenance activities. Until recently, consumers believed CMMS platforms to be expensive, complicated, and risky investments. The good news is that modern, cloud-based solutions have removed these barriers to entry. Organizations of all sizes—with workers with varying technical skill levels—can now execute planned maintenance programs with downloadable mobile apps that support importing asset lists, creating work orders, and team instant messaging.

Planned maintenance falls into two categories:

- **Preventative Maintenance:** Planned preventative maintenance aims to put in place a maintenance schedule that takes care of problems before they occur. For instance, manufacturers often recommend servicing vehicles every 5,000 miles. This scheduled maintenance task helps vehicles run smoothly; procrastinate car upkeep for too long, and it may stall at a dangerous or inconvenient time.
- **Planned Unscheduled Maintenance:** This approach entails undertaking maintenance activities after a failure has already occurred, although a recovery plan is in place to deal with these eventualities. Once again, the goal is to return equipment back to operation as soon as possible, without jeopardizing safety. Planned unscheduled maintenance helps minimize maintenance costs by avoiding last minute rush orders for replacement parts. For example, a vehicle owner may purchase a spare battery in case the current one dies.

Planned Maintenance Advantages vs. Disadvantages

Planned maintenance has several benefits for a company. Advantages include:

Decreases Downtime: Planned maintenance enables teams to resolve issues before they result in failure. Even when a failure occurs, technicians can “follow the plan” to get equipment up and running quickly.

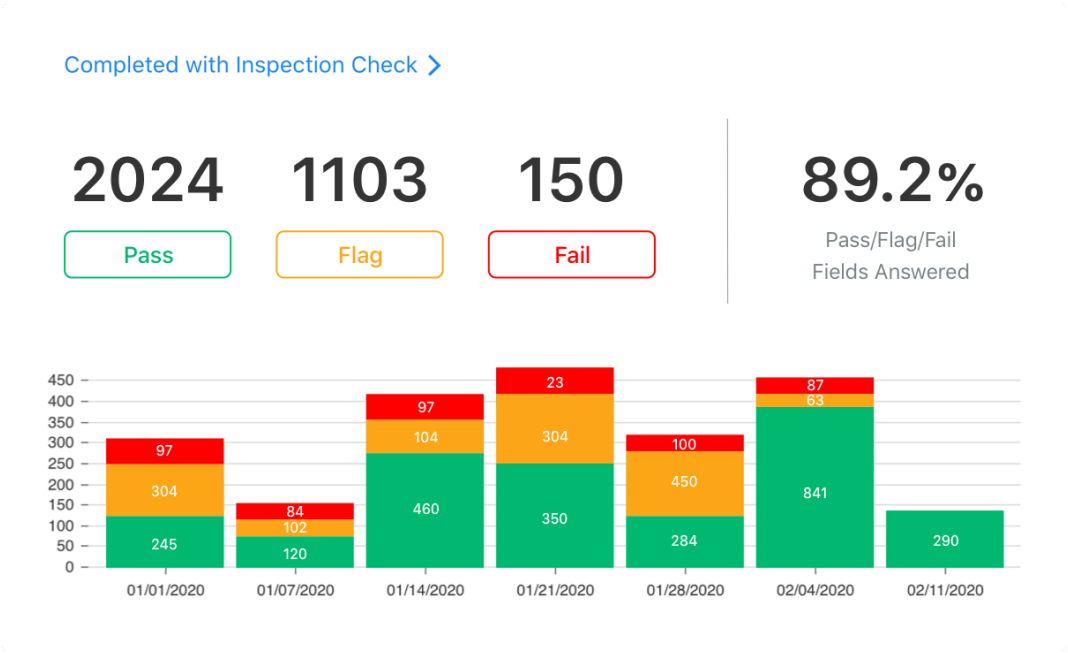
Increases Asset Life Span: Regularly serviced equipment lasts longer.

Reduces Maintenance Costs: Planned maintenance programs allow teams to handle breakdowns efficiently, without spending extra capital on the expedited delivery of replacement parts or outsourced maintenance services.

Improves Workplace Safety: Assets operating in optimal conditions ensure those in close proximity are kept safe. Planned maintenance minimizes the risk of disaster.

Enhances Company Culture: Frequent unexpected downtime can interfere with employee morale, increase stress, and leads to dissatisfaction. Facilities that minimize downtime foster greater contentment for all.

With that said, scheduled maintenance *does* have disadvantages. It is biggest drawback is that unnecessary tasks may sometimes be completed. If the servicing technician inspects equipment that does not need upkeep, he will have wasted time that he could have spent on a more urgent work order. Inefficiently run preventive maintenance programs can increase maintenance costs over the long run.



5 Steps to Scheduling Maintenance Tasks

Proactive maintenance is an essential part of maximizing equipment usefulness, reliability, and value. However, organizations are often unsure of how to create a sustainable planned maintenance process. Take the following steps to build a functional planned maintenance plan for each asset, starting with the most important:

- **Identify equipment failure modes and create a work order:** Outline the scope of work to be completed. Gather information on the asset in question, its failure modes, and any other related data that might be useful during maintenance.
- **Conduct an inspection of the asset and its surroundings:** Outline the details of the maintenance tasks to be performed in the event of failure. Ask yourself questions like: *What tools will I need? Which replacement parts must be available? Are there any work environment factors that could affect maintenance?*
- **Prescribe a work process:** Document the maintenance process for the asset step-by-step, including additional other standard operating procedures outlining safety precautions, shutdown procedures, and other important information.
- **Create priority levels:** Once you have several recurring work orders scheduled, prioritization becomes essential. Always handle tasks that return facilities to optimal operations levels ASAP.
- **Schedule your planned maintenance program:** Finally, assign your maintenance tasks to the appropriate technicians. Once again, a user-friendly CMMS app can simplify the process tenfold.

What Equipment Should Be on a Planned Maintenance Schedule?

Different companies have different types of assets and maintenance needs. It is difficult to pinpoint all the specific items to put on a planned maintenance program. However, these are the most common items included in a planned maintenance schedule:

- **Filters:** This includes water filters, filtration parts, grease and baffle hood filters, HVAC filters, and office air filters.
- **Belts:** Conveyor belts and belts on other equipment should be inspected and changed regularly when they show signs of wear and tear.
- **Instruments Recalibration:** Calibration delicate instruments after a given number of uses.

- **Vehicle Maintenance:** Tire rotation, oil changes, state inspections, and cleaning are some of the maintenance tasks you will need to carry out regularly if you manage a fleet of vehicles.
- **Compressors:** Frequently inspect your compressors to ensure they have no cracks or wear and tear. Faulty compressors can be a safety hazard.
- **HVAC Maintenance:** HVAC systems should be inspected and cleaned regularly to ensure proper airflow and energy efficiency.
- **Light Fixtures:** Dust can gather on lighting fixtures and reduce the amount of light reaching production areas. They need to be dusted off frequently and burned-out bulbs replaced.

The list of assets you can add to a planned maintenance program is endless. These are just a few to get you started. Having a CMMS can help you set up an efficient maintenance schedule.

What Is Unplanned Unscheduled Maintenance?

Finally, despite a maintenance team's best attempts, it will sometimes find itself putting out fires—figuratively and hopefully not literally. This type of work is referred to as **unplanned maintenance** and is often the result of unanticipated equipment failure. Unplanned maintenance can be expensive, dangerous, and time-consuming. For this reason, organizations should thoroughly examine the failure modes of each asset.

Conclusion

Planned maintenance is an ideal strategy for companies wanting to minimize maintenance costs, boost profitability, and enhance safety. Combine the previously described steps to build a planned maintenance program with a user-friendly CMMS platform. You will wonder why you did not do it sooner!

11

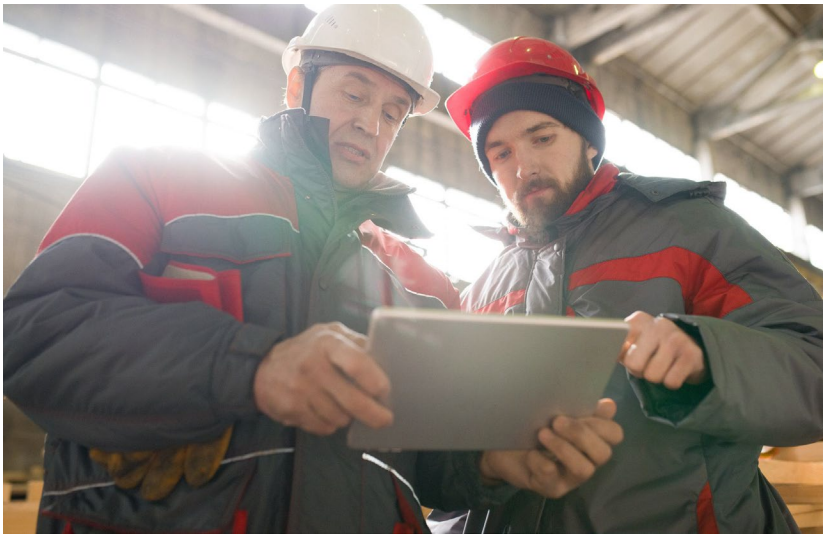
How Strong Operational Leaders Implement and Monitor KPIs Effectively

From: https://www.thomasnet.com/insights/how-strong-operational-leaders-implement-and-monitor-kpis-effectively/

Introduction

As remote work continues into the foreseeable future, maintaining productivity, fostering accountability, increasing efficiency, and reducing liability are essential. For employees accustomed to the benefits of collaboration, adapting to the physical isolation of remote work is incredibly challenging and amplifies inefficiencies that existed before COVID-19

As a result, management needs to be more deliberate in designing, implementing, and monitoring work. Next to ensuring customer and employee safety, capturing data for actionable, transformative leadership is job one. Gathering this data is not as hard as it sounds. Modern connected worker platforms can capture data that leaders use to measure employee productivity and output without being on the frontlines.



Leading a Connected Workforce

Metrics collected from work orders (WO) can demonstrate how effective or ineffective an organization is operating. Modern connected worker dashboard metrics include information calculated through work orders, such as WO completion, time on task, reactive vs. preventive ratio, mean-time-between-failures (MTBF), mean-time-to-repair (MTTR), safety inspections, inventory cost tracking, and more.

A modern connected worker platform calculates these metrics based on how efficiently an organization's frontline team inputs information into their system of choice. Notably, this data's value decreases over time, and real-time entry is crucial to calculate simple dashboard metrics, both leading and lagging, and for using more advanced KPIs such as Overall Equipment Efficiency (OEE), and generating useful predictive analysis.

Leading toward Efficiency

The PDCA model for change leadership—Plan, Do, Check, Act—works well because it engages both leadership and employees in change.

Integrating a PDCA model into information gleaned from KPIs means that a leader will engage employees at essential stages of the process, from:

- Choosing the appropriate software platform, if one is not already in place;
- Building lists of asset and equipment that need to maintain under the plan;
- Creating work orders and standard operating procedures to maintain both equipment and operational standard;
- Assigning work orders to appropriate teams and employees;
- Executing work orders following best practices; and
- Completing all required information on the platform.

From the moment a work order is created, a modern connected worker platform begins calculating efficiency and productivity.

Leading with KPIs

1. Use KPIs to Measure Performance

Although organizations may favor some metrics over others, standard asset maintenance KPIs revolve around a few key elements surrounding work order completion, including:

- Work Orders Created v. Completed
- Time to Complete and MTTR
- Preventive vs. Reactive Work Orders, including MTTR on Reactive work orders
- MTBF
- Work Orders with Inspection Checks
- On-Time and Overdue Work Orders
- Work Order Time and Parts Cost Tracking

2. Use KPIs to Measure Asset Efficiency

For example, Overall Equipment Efficiency (OEE) uses three key indicators: equipment availability, quality, and performance to calculate the percentage of time a machine can operate (uptime). Availability equals the amount of time a machine is available, performance is the percentage of maximum operation speed used, and quality is the percentage of good produced parts.

OEE% = Availability * Performance * Quality

MTBF is another useful KPI for leaders when considering equipment costs. MTBF equals the operation time between failures divided by the number of failures. MTBF can help inform capital allocation to increase efficiency across the operation.

MTBF = Production Time / Failures

For example, a production line unit (Asset A) may have been on for 2500 hours in a given year. In that year, however, the unit overheated and went down 12 times. Therefore, the MTBF for the line is a little over 208 hours. If, comparatively, the average MTBF of similar production line assets in the factory has an MTBF of 800 hours, you can quickly identify your outlier.

The higher the MTBF, the longer a system is likely to work before failing. If the MTTR is 2 hours, Asset A has caused 24 hours of downtime in your operation. If this production line yields $20,000 per hour, those 24 hours of unplanned downtime could amount to $480,000 of lost production output. If you factor in the cost to repair Asset A, both labor

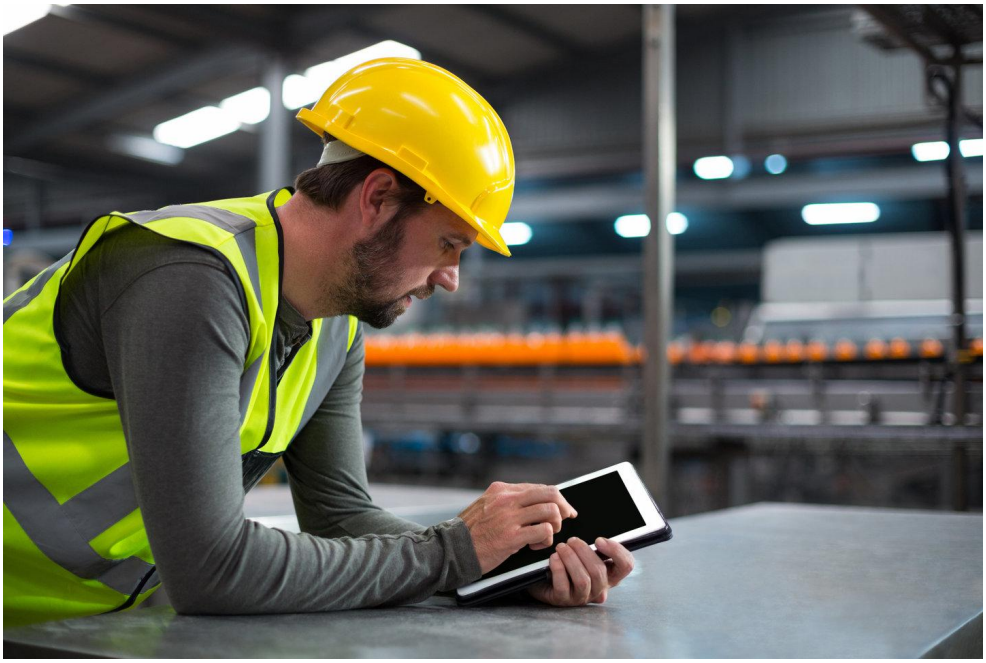
and parts, you may conclude that it makes sense to allocate budget to replace Asset A this year.

Leading with Training and Continuing Education

In addition to collecting and analyzing KPI data, leaders can ensure that employees are well trained to complete standard operating procedures efficiently and safely. Actionable insights generated by a connected worker platform provide opportunities for training, and even re-training, to build employee buy-in and reduce errors.

Likewise, leaders can work to ensure when a work order is created and assigned that the right technicians are available to efficiently complete the highest priority work order, rather than creating a bottleneck, backlog, or worse, downtime.

Since the early 1990s, researchers have studied how leaders can effectively motivate change in the workplace. Higgs and Rowland (2000), in the *Journal of Change Management*, identified “change leadership” as the “ability to influence and enthuse others, through personal advocacy, vision, and drive, and to access resources to build a solid platform for change.” Change is possible when good leaders provide workers with the time and resources to grow into and excel with change. Training, feedback, and opportunities to encourage workers to improve KPI metrics go a long way to eliminating any anxieties brought on by workplace change.



Leading with Accountability

Without rigorous accountability, leaders cannot trust the integrity of the data. If an organization's processes involve data entry from a clipboard or spreadsheet, inputs will lack the fidelity required to make the most accurate decisions. Insights may still be possible, but leaders may be vulnerable to variables they cannot trace easily without a digital audit trail. If an employee records a gauge reading on a clipboard or marks a preventive maintenance task as completed on a checklist, it is cumbersome, if not impossible, to audit the timing. One could reference security camera footage or potentially access a sensor's historical reading, but that simply does not scale.

Accountability and digital transformation efforts go hand-in-hand. Strong leadership, built on transparency, employee buy-in, and SMART goals, can create an organizational culture of improvement and dedication.

Strong leadership in this area requires leaders to retain top employees, those with the skills and training—or the willingness to learn new skills—to meet maintenance KPIs, especially as a company grows.

Moving to a KPI model that includes tracking employee performance metrics means that employees need to understand and buy into a system based on measured performance. Are employees willing to meet this quantitative challenge? Do they feel more engaged? Are they taking advantage of skills training to grow with the demands? Employee engagement metrics may be an additional, but equally important measurement to understanding KPI success. Leaders and managers should also create opportunities for 1-1 real-time feedback with team members.

Leaders who actively seek to measure and improve performance need to locate what is causing work order bottlenecks and what they may be seeking as far as additional training. Let team members know how you calculate performance beyond the KPIs. Is everyone working productively on what matters most? Explain to your team how the KPIs you choose to measure the appropriate activity in each area. Finally, in addition to not having too many KPIs, which can cause employees to feel scattered and unsure of what is most important, set SMART goals to improve KPIs.

Doran's 1981 article, "There is *a S.M.A.R.T. way to write management's goals and objectives*," defined how leadership could outline objectives in such a way that they were both useful and achievable. By using the acronym SMART, he explained that goals should be:

- Specific – target particular area for improvement
- Measurable – quantify indicator of progress
- Assignable – specify who will do it
- Realistic – state what realistically can be achieved, given available resources
- Time-related – specify when result(s) is due

By defining and using smart goals combined with KPI reporting dashboards to increase a company's productivity and efficiency, strong leaders provide employees with achievable performance goals.

Conclusion

As an operational leader, measuring your results will define your organizational success. For most team members, implementing connected worker platforms will be a welcome change - top performers will feel validated with accurate performance metrics. Management will find new opportunities for optimization exciting and attainable.

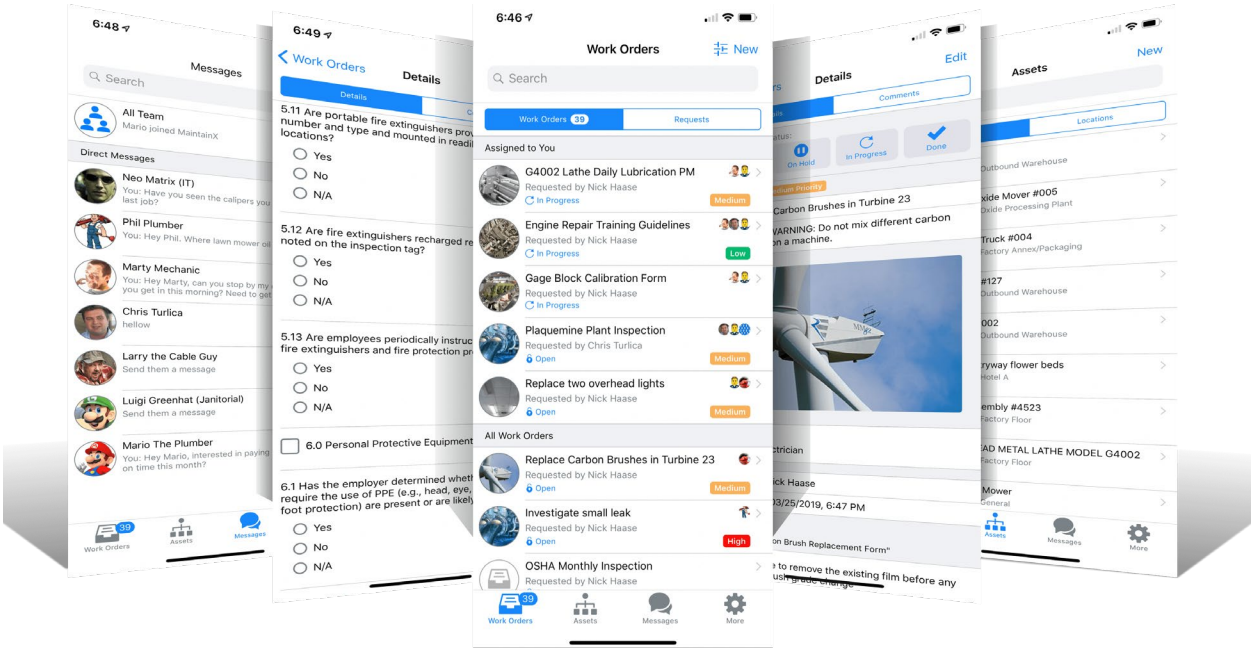
So put away those clipboards and jump into the digital transformation movement. Your team will thank you!

12

MaintainX and Key Performance Indicators (KPIs)

As you no doubt know by now, work order management software is a solution that allows facilities managers to effectively track and manage all work order information through a single dashboard. Like MaintainX, when you use a centralized place to create service requests, monitor real-time status updates, track work order completion, and leave feedback on work performed, you can easily manage work orders across a multi-location enterprise.

A well-designed work order management system can be both intuitive and comprehensive. That is, it should be **simple** to manage your **entire** work order process from start to finish. Instead of employees manually submitting service requests, work order management software automates the process: With only a few clicks, a work order can be entered, approved, and dispatched to a contractor.



However, your work should not stop there, even if using MaintainX has already made a world of difference. Our interactive dashboards show you everything you need to run your team and manage your assets with precision.

By analyzing work orders created and resolved in a specific department, across a facility, within a team, or completed by an individual, you will get both real-time snapshots and deep dives into how the work is getting done.

KPIs are key performance indicators and understanding how they work is essential. Key to all of this is that reporting provides the metrics and information to identify opportunities for improvement. We like to say that what gets measured gets improved

In the meanwhile, understanding why we use KPIs is essential. One driver is, of course, financial. Questions such as “How much money do we need?” “Where should it be directed?” and “How do we know we are using our resources wisely?” are the kinds of questions we need to ask when we analyze our reporting dashboards.

The MaintainX reporting dashboard captures industry-standard KPIs, including workforce productivity, completion rates, distribution type, and open work orders, to name a few. Dashboard metrics are essential for many reasons, but perhaps the most important is that they are evidence of the success or failure of workflows throughout a company or a team, with an individual or even with a particular piece of equipment. In the best of all worlds, we want our workflows, our work orders, to be completed on time, efficiently, and with minimal costs. How we get there is another story.

One of the things you will realize fairly quickly is that the data is only as good as what is input by the people doing the work. If no one is creating the MaintainX work orders correctly in the first place, it will be hard to gather the data you need. Similarly, if the work orders are created correctly, but no one fills them out, your data will also be incomplete.

Once you start inspecting the data, you will gain a good sense, in real-time, of how the work is being done, how your machines are functioning, how costs are rising and falling. In addition, with this information, you can act on the data in the reports to get where you need to go.

In MaintainX Reporting, you have access to eight reporting dashboards, as well as grouping reports by user or asset and looking at all repeatable work orders. From each of these reports, you can home in for more real-time details. Simply click on the name of the chart for a full-screen view of that report. From here, you can filter work order details to go deeper into the specifics.

8 Reporting Dashboards

From Reporting, in the Summary view, you can click on any chart for more detail.

You can also move from Summary to an individual chart for more detail by clicking on the Reporting Details tab and selecting one of the individual Reporting Dashboards.

The eight Reporting dashboards provide you with detail about work order completion. They are:

- Created & Completed,
- Repeatable & Reactive,
- Status,
- Priority,
- Completed With Inspection Check,
- Time to Complete,
- On Time & Overdue, and
- Time & Cost Reports.

Navigating Real-Time Data

Real-time data allows you to be nimble and accurate. Real-time data enables you to check your work force's efficiency and effectiveness, equipment, assets, and inspections. As they happen. We cannot really be any faster than that.

Analyze Performance across Teams and Sites

In addition to the real-time functionality of the Dashboards, you can also look at each individual dashboard and customize the details you are most interested in. To do this, we offer a range of reporting filters by time and by data.

We also recently updated our Asset Type filter so that you now add multiple Asset Types to any one Asset. You no longer need to choose only one Asset Type at the expense of under-classifying an Asset. For example, if you want to tag a Clark Forklift with an Asset Tag of "Forklift," "Clark," and "Fleet," now you can. This can help you run more effective reports when you leverage Asset Type filters.

Through these dashboards and filters, you can home in on how your team, equipment, assets, and facilities are performing and use this information to make data-driven decisions.

It is important to realize here that these filters only work if those filling out the work orders fill in these categories. From those who create the initial work order request to those completing the work order in the field or floor.

For example, suppose a team's work orders do not uniformly list the asset's location that needs to be maintained. When you filter by location, your location data will be inaccurate.

Work order management software is a solution that allows facilities managers to effectively track and manage all work order information through a single dashboard. As with MaintainX, when you use a centralized place to create service requests, monitor real-time status updates, track work order completion, and leave feedback on work performed, you can easily manage work orders across a multi-location enterprise.

By analyzing work orders created and resolved in a specific department, across a facility, within a team, or completed by an individual, you will get both real-time snapshots and deep dives into how the work is getting done.

Using the right CMMS helps organizations navigate real-time performance data for KPIs.

- Identify insights that allow you to highlight organizational bottlenecks and take action,
- Track assets to manage asset downtime and capital equipment allocations,
- Monitor team performance to identify top performers and employee performance efficiency, and
- Monitor metrics to calculate KPIs across assets, teams, and locations.

Repeatable & Reactive Work Orders Reporting

The **Repeatable & Reactive Work Orders Dashboard** shows how many work orders in your organization are planned and/or repeated versus unplanned and reactive. For this dashboard, you most likely will want to group work orders by asset—to get a sense of which pieces of equipment are breaking down and needing teams to react to their failure.

Managers should shoot for 20-30 percent of completed work to be reactive. In other words, organizations with best-in-class maintenance strive for 80-85% of their maintenance to be planned and repeatable to improve safety, reduce downtime, and increase asset lifespan.

Planned maintenance percentage (PMP) is an indicator that compares the amount of maintenance time used towards planned maintenance tasks against the total amount of maintenance hours in a given time period (weeks, months, years).

$$\text{PMP} = \frac{\text{\# of planned maintenance hours}}{\text{\# of total maintenance hours}} \text{ X } 100$$

$$87.5\% = \frac{\text{175 hours planned maintenance}}{\text{200 total hours maintenance}} \text{ X } 100$$

Monitoring the Repeatable to Reactive ratio allows maintenance teams to better understand how their maintenance plans are working out and to improve their strengths while targeting their weaknesses.

For more information about using KPI data to improve performance, check out: Facility Preventive Maintenance: How to Gain Executive Support.

Work Orders by Status Reporting

The **Work Order Status Dashboard** is an easy way to get a high-level perspective on how many work orders are currently outstanding across Teams, Users, Assets, Locations, and Categories.

To get more details on any of the categories—Open, On-Hold, In Progress, and Done—simply click on the number. If you group by team, you will get a good idea of the work that individual teams still need to complete. If one team has completed all of its work orders, while another team with similar work orders has not, you may have productivity issues, for example. If more than the usual number of work orders are on-hold, you will want to continue to monitor team capacity and efficiency and address any bottlenecks.

For more information about the benefits of repeatable preventive maintenance, check out: The Ultimate Preventive Maintenance Guide: Nearly Everything You Need to Know.

For more information about reducing downtime, check out: Avoid DOWNTIME: Write Standard Operating Procedures.

Work Orders by Priority Reporting

The **Work Order by Priority Dashboard** displays a breakdown of each work order by its priority tag—None, Low, Medium, and High.

Successfully prioritizing your work orders is a crucial tenet of system efficiency. It is imperative to employ a standardized set of rules for prioritization that leads to consistency throughout the process. Any work request to remove the risk of injury or significant asset damage should be evaluated immediately. The routine requests that occur every day can be addressed at the appropriate time.

For more information about prioritizing work orders, read up on the Types of Preventive Maintenance.

Inspection Checks Reporting

MaintainX Reporting Dashboards identify how many work order **Inspection Checks** have Passed, Flagged, or Failed in your chosen reporting period. This dashboard provides vital information to identify inspection trends and the root causes of failures, downtime, and possible safety hazards. Obviously, any flags or failures indicate it is time to address the issue.

This dashboard also serves as an essential audit history of safety and compliance. Inspection Check work orders can include standard operating procedures that walk through common inspection checks. The MaintainX Procedure Library can store this information to attach to other work orders when needed.

For more information, check out Standard Operating Procedures across Industries.

To read more about safety, check out: Safety Lessons from the Beirut Blast.

Work Orders by Time to Complete Reporting

The **Time to Complete Dashboard** tracks how much time was spent across your entire organization completing work orders. Using filters will help you home in on the specifics, by team, asset, date, categories, etc. This dashboard identifies bottlenecks that cause MTTR and Downtime numbers to rise and allows you to benchmark maintenance teams against one another to improve operational efficiency.

Here, we provide details on the total hours it took to complete work orders during a given time period, the average number of hours, and the Mean Time to Repair Average hours.

The time is calculated from the time a work order is created to the time a work order is completed. For repeating work orders, the time is measured from the “Created Date” of that work order.

The KPI, Mean-Time-To-Repair (MTTR), is only calculated on reactive work orders. This timer starts when the work order is created to account for total Downtime (not just Wrench Time).

The MTTR KPI provides critical productivity data on your organization’s ability to repair equipment quickly, or not, after a failure.

$$\text{MTTR} = \frac{\text{Total Maintenance Time}}{\text{\# of Repairs}}$$

$$4\text{ hours} = \frac{\text{20 hours total reactive maintenance time}}{\text{5 repairs over specified period}}$$

By keeping a data-driven mindset and proactively improving your company’s MTTR with training, better instructional information within work orders, you can reduce equipment availability losses due to repairs. The idea is to speed up the equipment’s rate of recovery from failures and breakdowns.

Work Orders by On-Time & Overdue Reporting

The **Work Orders by On-Time & Overdue Dashboard** highlights how well your organization completes work orders on time (by the due date). It can also highlight how many Reactive work orders do not have a due date assigned at all. This may or may not be a problem for specific work orders, but it is a good idea to provide your team with structure (i.e., letting them know when tasks need to be completed).

A maintenance team’s On-Time & Overdue Work Order stats also help you understand its historical bandwidth and efficiency. Do the same teams always have overdue work orders, even if they are able to complete them? The reporting data from this dashboard can help you justify additional headcounts and evaluate the efficiency of those assigned to get the work done by the deadline. This is especially important when, as we mentioned with the Created & Completed Dashboard data, maintenance depends on schedule compliance.

For more information about eliminating downtime, check out: 8 Steps to Creating Efficient Standard Operating Procedures.

Time & Cost Tracking

Time & Cost Tracking can be surprisingly complex. We created space for organizations to feel comfortable learning new workflows while also providing the power and functionality that enterprise leaders need.

From this dashboard, we can calculate reports by Total Reported Time Spent on a Work Order and Total Reported Cost Spent on that particular work order, including both the cost of parts and paying someone.

We designed Time & Cost Tracking features to help you drive the actionable insights to take your organization to the next level. These insights identify resource-intensive assets and equipment, highlight organizational bottlenecks, and inform capital-planning decisions.

This dashboard works because advanced budgeting and capital decisions should integrate labor and inventory costs with the work order management system. You can use this dashboard to make the right decisions about equipment, spending, the cost of your employees versus the cost of outside techs, and more.

We know that too often, the cost of repairs can get lost. Here, via the work order, we can keep track of time and cost, and easily view it on the reporting dashboard. You can make capital expenditure decisions based on which Assets cost the most to maintain. You can evaluate the allocation of time and resources of your Team and Staff.

For more information about a range of topics important for tracking your maintenance in order to improve your organization's efficiency, productivity, compliance, and safety, we recommend you review MaintainX's Support Center, blog posts, and Learning Center.

We have a fantastic ever-growing set of resources for you on MaintainX. Our blogs cover the range of our features and use cases. Our support includes instructional materials, and our learning center provides courses like this one, explanatory materials, and answers to your questions. Please also always feel free to chat with us live by going to our website and clicking on the Chat emoji at the bottom right of your screen.