

A photograph of a male worker in a yellow hard hat and blue work jacket, wearing yellow gloves and using a wrench on industrial machinery. The background shows a complex industrial setting with pipes and valves.

Take Control of Your Maintenance KPIs



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Introduction

There is a lot of churn in a normal week of maintenance. Jobs take longer than expected, jobs finish earlier than we thought, and operations continually calls with new work that cannot wait until next week. The last thing anyone needs is to make the situation worse by micromanaging or measuring maintenance performance against misleading KPIs.

This ehandbook offers practical advice on what maintenance performance KPIs are useful to measure and which are misleading. It also offers solid tips on how to calculate both your own value to the business and the value of investments in skills training.

Why the most common maintenance planning KPI is hurting your department

Doc Palmer says hyper-accurate labor estimating gets in the way of both completed work and higher quality work.

By Doc Palmer

Key performance indicators (KPIs) provide control to management. Are we, in fact, doing what we need to do? Nonetheless, not all KPIs are useful. The most common maintenance planning KPI, Plan versus Actual (PVA), is actually counterproductive. By using it, we cripple maintenance.

KPIs give “control,” telling us if we are doing what we need to do. But KPIs are not the only form of control. We could do everything ourselves to ensure things are done correctly. We could have frequent meetings to make sure everyone is on the right track. We could also directly supervise everyone to make sure they do a good job. Another way to control would be to hire skilled persons who know what to do and turn them loose to do what we want done.

Each of these forms of “control” has its place, but reliance on KPIs is best used at the upper management level across different company areas. Among choices, the best form of control for planning itself is having skilled persons who know what to do. Nevertheless, PVA is commonly used with maintenance planning.

This KPI compares the estimated labor hours for a work order to the actual labor hours charged. A work order estimated for 5 hours has 10 hours charged to it. Should we deduce from PVA that the crafts take too long, or that the planner was not good at estimating? Therein lies the rub.

On one hand, if we are “grading” planners, planners that give extra time for all jobs get better scores because of Parkinson's Law (PL: The amount of work assigned

expands to fill the time available.) If a planner thinks that a job honestly should take 5 hours, the planner might plan it for 8 hours “just in case” something goes wrong or if the supervisor assigns a normally slow mechanic. Then, upon assignment, a normally fast mechanic gets an allowance of 8 hours to do a 5-hour job. Parkinson’s Law kicks in and the mechanic takes 8 hours. The planner gets a great score!

On the other hand, if we are grading craftsmen to meet the estimate, craftsmen get a better score if they ignore needed steps taking them past the allotted time. So, if we grade planners, we compromise productivity because planners inflate time estimates and we cannot assign more work. But if we grade craftsmen, we compromise quality because craftsmen cannot afford to take extra time when needed to do jobs properly. What a lose-lose KPI!

The PVA KPI is popular for two reasons. First, it seems obvious that planners should accurately estimate labor hours for jobs. Second, it is difficult to imagine another measurable planner KPI. But hyper-accurate labor estimating is not needed. It does not help us complete more work than normal. It does not help us do higher quality work.

Instead, let’s address the purpose of planning and scheduling. The purpose of planning, per se, is not to have

hyper-accurate labor estimates. Instead, the purpose of planning is to help us have more helpful job plans over the years to improve work quality. Planners accomplish this bettering of job plans by incorporating craft feedback to make plans more helpful over the years. A better KPI would be ensuring planners use the job plan module of the CMMS to make living plans when they plan jobs. Do they?

And the purpose of scheduling is not to have hyper-accurate labor estimates. Instead, the purpose of scheduling is to help us complete more work than we would normally complete. This increase in productivity is accomplished by fully loading schedules to defeat Parkinson’s Law. A better KPI would be ensuring schedulers fully load weekly schedules. Do they?

Nonetheless, we do need time estimates to manage work. We need them to help us build schedules and assign work. One method of estimating would be to build up the estimates considering job factors, such as how far from the shop, how many bolts, what motions are required, and so on. Adjustments could be made for factors, such as temperature and height. But we still do not know if a slow craftsman or a fast craftsman would be assigned. And we still do not always know the exact scope for reactive work. Another method would be to consider history. But Parkinson’s Law tells us that historical actual labor hours might be

too high if enough work was not assigned at the time.

Instead of building up estimates or merely averaging history, planners simply making a reasonable judgment usually suffices for scheduling and assigning work. The planner presumes an assigned craftsperson generally has the skills and there will be no unusual problems with the job. Planners use their own experience, talk to certain craftspersons, or scan history for an idea of labor time. But in the end, planners quickly make a simple judgment. These time estimates vary widely in accuracy for individual jobs, but as many go over as under.

In the long run they average out for “accurate-enough” estimates making them useful for generally assigning work and building schedules. (This is what we wanted in the first place.) But because the accuracy varies widely, the time estimates do not replace the need for active supervision in the daily churn of maintenance with many jobs taking longer or finishing sooner than expected. We conclude that we need time estimates to manage work and planners can make useful time estimates. But there is no need for super-accuracy and there is great danger in holding planners or crafts accountable to exact times.

Let's return to the issue of controlling planning itself. The primary control

mechanism for planning itself should be to hire the right persons and turn them loose to do what we want done. Hire planners with great communication skills and data organizing skills. Great craft skills would be a plus to give them “street credibility.” Let planners freely and quickly make judgments for time estimates.

If we must measure planners with KPIs, grade whether they are using the job plan portion of the CMMS to make living plans. Thereby planners make “better” plans over the years to improve work quality. Also grade whether schedulers fully load schedules to 100% of the next week's labor capacity. Such schedules defeat Parkinson's Law to improve productivity.

Complete more work and better work than ever with proper planning and scheduling control. Don't settle for being good plant. Be a great plant!

About the Author

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Why micromanaging your plant's daily scheduling doesn't work

Doc Palmer says a daily schedule will focus that day's work, but supervisors need the flexibility to react to unplanned work.

By Doc Palmer

We cannot schedule to the individual day a week in advance. The first line supervisor should develop the daily schedule each day for the next day. To deploy craftspersons to jobs as the maintenance week unfolds, we must rely on the individual supervisors exercising their skills and judgment on a daily basis.

The Maintenance Planning and Scheduling Handbook, states the fifth principle of scheduling as, "The crew supervisor develops a daily schedule one day in advance using current job progress, the 1-week schedule, and new high-priority jobs as a guide. The crew supervisor assigns individual crew members to work considering personnel skills and work order requirements. The crew supervisor handles the current day's work and problems,

even to rescheduling the entire crew for emergencies. Maintenance and operations use this schedule to coordinate their efforts on a daily basis."

There is a lot of "churn" in a normal week of maintenance. Jobs take longer than we thought, jobs finish earlier than we thought, and operations continually calls with new work that cannot wait until next week. We could think that with "great" planners, we could estimate jobs down to the hour. Yes, we could, but only if the planner understood the job scope perfectly and if every craftsperson was "typical." But on a lot of reactive work, we do not understand "exactly" what the execution will involve. We could say to ourselves that we should not have any reactive work and that would solve everything. But the first maintenance

conference I attended in 1993 proclaimed that only three plants in the entire world were deemed “world-class” with minimal reactive work. I do not believe there are many world-class plants even today. Not even close to world-class, having only 20% of our work being reactive would make us a good plant. Most of our real-life plants are not world-class and we do have lot of reactive work with uncertain job scopes. Furthermore, even if we did know the exact scope of each job, the “typical” craftsperson does not exist. Some persons are naturally slower than others. We do not want to speed up slow persons at the expense of quality. We do not want them to hastily execute work or take shortcuts just to meet arbitrary time estimates. And honestly, some workers are faster than others. If they execute work properly, we certainly do not want to slow them down. As a result of having reactive work and different craftspersons working at different rates, we cannot say exactly what we will do every day of the entire next week.

Supervisors handle this churn. Each day the crew supervisor keeps up with the status of different jobs. As jobs finish early or late, the supervisor directs persons to other jobs that might have been originally assigned to other persons. As operators call with emergency jobs, the supervisor decides which ongoing jobs might soon finish and alert the crafts where to go to take care of the emergency. Alternately,

the supervisor might decide to interrupt an ongoing job and not wait. Appropriately, the industry rule of thumb recommends that supervisors should be in the field 75% of their time (six out of eight hours)!

Typically, around lunch time, the supervisor, considering the work in progress, starts figuring out a schedule for tomorrow’s jobs and assignments. Late in the afternoon, the supervisor coordinates with the appropriate operations counterpart to see if LOTOs (lock-out/tag-out) can be scheduled. This coordination can be informal or at a short formal meeting toward the end of each day. The supervisor then posts the schedule as “what we think we will be doing tomorrow.” (This posting really helps crew morale. Many craftspersons honestly would like to know what they will be doing a day ahead of time.) The next morning, the crew checks in, and the supervisor makes adjustments based on any absences and new jobs that came up overnight and cannot wait. The supervisor now uses this daily schedule to monitor the day’s progress and begin figuring out a schedule for tomorrow.

Whereas the weekly schedule is simply a batch of work with the craft requirements (mechanic, electrician), the daily schedule has names of individuals (Fred, Sally) for the different jobs. The weekly schedule is simply a batch of enough work for the crew for the entire week. It is mostly a soft schedule although there may be a few hard

dates. The scheduler has looked through the planned backlog to bundle work for convenience of location and LOTO. A huge purpose of the weekly schedule is to focus the supervisor and crew to try to do a certain amount of work in the midst of the churn of uncertain times and operators calling. This focus increases productivity beyond the normal practice of primarily taking care of operator calls while making sure everyone has something to do. A secondary purpose of the weekly schedule is to coordinate maintenance capacity with operations needs on a weekly basis. The purpose of the daily schedule is to assign the work to the best person(s) for the different jobs as jobs and persons become available. A secondary purpose of the daily schedule is to provide for daily coordination with operations.

In their 1983 book *In Search of Excellence*, Tom Peters and Robert Waterman distilled eight common denominators of long-term successful companies. One of these traits was the concept of “tight and loose.” There are tight things you have to do or you are not allowed to work here. You can do the loose things any way you want. That’s why we hire talented people to make judgments. For us in maintenance, the tight is the weekly schedule. We are going to start each crew with a fully loaded schedule every single week as a focus. The loose is that the crew supervisor can assign the work just about any way he or she wants as the week unfolds. Tight and loose is similar to “Pick

your battles,” “Don’t sweat the small stuff,” and “Some things are past the point of diminishing returns.”

Don’t micromanage the supervisors. Instead, manage them by freeing them up to be in the field with a fully loaded weekly schedule. Empower them to manage from there. Repeat each week. Go beyond good to great, maybe even world-class one day.

About the Author

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Are your FMEAs focused on the asset or plant level?

Jeff Shiver says take your continuous improvement efforts to the next level by expanding the scope of failure modes and effects analyses as needed.

By Jeff Shiver

The role of continuous improvement in a manufacturing plant is to identify and implement changes to improve the production process's efficiency, quality, and safety. This may involve identifying and addressing bottlenecks, streamlining processes, and implementing new technology or techniques to increase productivity and reduce waste. Continuous improvement can also help you reduce costs and stay competitive in the market.

The plant's management team may lead ongoing improvement initiatives, but they should involve input and participation from all levels of the organization. Tools like root cause analysis, process mapping, and determining maintenance strategies using reliability-centered maintenance approaches come into play. Some of these approaches can require the plants

to commit to longer-term investments, either in time or resources. Both are in short supply for plant managers, who are measured on this month's or quarter's results; these pressures can be compounded by supply chain shortages that make it more challenging to meet the business targets.

The challenge is for maintenance and reliability professionals to think more like business owners, more holistically and proactively. Rather than waiting for equipment failure to drive root cause efforts (if the impact is significant enough to meet the incident reporting criteria), you should be leveraging tools to prioritize efforts to reduce downtime, delays, or other factors that impact the business objectives. For most, that process starts with the question, "what keeps the site or

a production line from getting product out the door to the customer, on time, right the first time from a quality perspective, and at the right cost?"

Through his books and teachings, Ron Moore has been a great resource on my reliability journey. Moore taught me to leverage failure modes and effects analysis (FMEA) to prioritize continuous improvement activities beyond the individual asset. Initially, however, I learned to apply FMEA for equipment failure from another author, Keith Mobley.

In my plant, we needed help to determine the methods to improve the reliability of a caramel cooker. Mobley led the initial FMEA analysis. While maintenance had opportunities to improve, real revelations came in how production operated the equipment. Our team learned that most failures of that cooker came from improper operation and clean-in-place (CIP) activities. Using FMEA for individual assets is the typical approach if used at all.

In contrast, rather than using FMEA at the asset level, Moore taught me to leverage the tool at a higher level, at the line or plant level, answering the question framed above. Answers to that question in the analysis are used to identify actions and prioritize them based on the business impact and difficulty.

Having leveraged FMEA at the line level numerous times with clients, here is the approach.

1. Determine the plant, production line, or system with multiple assets. We will focus on the production line level for the remainder of the article. Start with the line causing the most issues impacting the business.
2. Understand the software tool that you will use. If necessary, develop a spreadsheet that enables you to capture the analysis. The categories for a production line-level FMEA are different. Consider the headings of the item number, failure mode or issue, frequency, effects or consequences, quantified impact, cost, cases lost per event, annualized total effects, and difficulty to fix rating for the initial analysis. Add the action items, priority, desired completion date, and responsible party for the actions portion.
3. Identify a cross-functional team of operators, maintainers, quality techs, and supervisors as an example. You may want to include safety, engineering, quality, or others where necessary.
4. Facilitate the analysis meetings in four-hour blocks. A typical line-level analysis can be completed in a few days of four-hour blocks.
5. Using a four-quadrant chart, map the items with one axis being "degree of difficulty" and the other axis being

“impact in dollars or cases,” depending which one the team has standardized on. The chart will help the team decide on which items to take action.

6. Rank the items and action them.

Likely, items from the analysis will surprise people in the room. Raw or packaging logistics may consistently delay production startups. A lack of shipping trucks may force the line down when warehouse space does not exist to put the finished product requiring shutdowns or delays. Human Resources may take too long to fill open positions, then temporary personnel fill the empty operator slots without training, causing improper operation and downtime. Engineering may be required for reengineering specific asset functionality. And maintenance may have issues to address as well.

In the spirit of continuous improvement, revisit the analysis at least every eighteen months. What has changed? New issues will crop up, and the business requirements may also vary.

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Calculating your value contribution to the business

To drive success, Jeff Shiver says employees need to add value beyond their compensation costs.

By Jeff Shiver

In the last year, the term “quiet quitting” went mainstream globally. In social media, the term was defined and redefined. In short, it means doing the bare minimum required for the job, and not taking on additional tasks. While that may appeal to some individuals, it does not bode well for the team environment that most maintenance professionals operate in.

To that end, from a purely business perspective, what should your contribution be in terms of real money? When I share this concept in courses that I lead, most have never stopped to ponder the answer and are quite surprised at the exercise results.

Consider that you earn a salary of \$100k annually in the U.S. Many hourly

technicians earn this level of salary or more with their overtime. But that's not your real cost to the business. Let's break the actual cost down further by using some typical percentages. Your employer's cost will vary based on the benefits they provide you.

The employer cost is an additional 35% of your annual salary. The percentage can range from a minimum of approximately 15% to 65% or more (see Figure 1).

As an aside, Klipfolio.com shows the 2022 Payroll to Revenue Ratio by Industry benchmark for manufacturing is 18% based on U.S. Census data and PricewaterhouseCoopers research. The percentage means that for every dollar of revenue, \$0.18 is allocated to payroll expenses. The business also has other

EMPLOYER EXPENSE ITEM	COST IN USD
Your annual salary	100,000
Employer portion of Medicare & Social Security (FICA)	7,650
Federal Unemployment Insurance - FUTA <i>(varies but shown with the standard tax credit)</i>	42
State Unemployment Insurance - SUTA <i>(varies widely by state and employee turnover)</i>	700
Workers Compensation <i>(dependent on the state, industry, and position held)</i>	2,000
Employer portion of Health Insurance <i>(Kaiser Family Foundation study in 2021 for family coverage)</i>	16,253
401k match of 5%	5,000
Misc. items such as PPE and safety training <i>(varies widely)</i>	3,000
TOTAL	134,645

Figure 1: The full employer cost per employee is an additional 35% of the annual salary.

costs such as advertising and promotions, raw materials costs, logistics costs, and so on. Remember that revenue does not mean profit.

In discussing your contribution to the team and to the business overall, recognize that providing \$135k of value is only covering your costs. At that level of contribution, you have added no additional value that enables the business to continue. While excess revenue and ultimately profit seem like dirty words in our world today, they are required to sustain the business going forward. Think about that new laser

alignment system or infrared camera that was just purchased for your use. If everyone's contribution only covers their cost, then there is no money to purchase those tools.

At this point, you might be asking what your contribution should be. The short answer is a multiple of three to five times. For some businesses, it is seven times your cost or higher. Using the previous example, this means that the contribution must be in the \$400K-\$675K range. Using the seven times multiplier, it is almost \$1M. Improving your multiple separates you from the competition.

With those numbers, how will you make the contribution to the business objective?

There are only three basic ways that you can add value to the business:

1. Make the organization money by helping provide products or services.
2. Find ways to save the organization money by reducing costs or downtime as examples.
3. Develop something new for the business that adds value and benefits it.

Hopefully, you consider all three ways. Another tidbit to consider is with each downtime event, the profit that would have been made during that downtime period is lost forever and costs are increased.

Another change to consider is hybrid work and especially fully remote work. I have been to some sites where the planners only come into the office two times per week and in one case, the planner has not returned since the pandemic. How do you walk down jobs to

create detailed job plans if you are not on the site?

Here is something that you may not have considered with regards to your value-add for the business in this case. If the position can work fully remote, there is someone out there in the world who has the same level or higher of education, lives in a less costly area, has similar experiences, and is willing to do the job for less. Controversial? Yes, but in a connected world, this becomes the reality. One does not have to look far for examples in other fields.

Bottom line, you set yourself apart by the value you bring.

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Building the business case for training and development investment

Adrian Messer says follow these guidelines to develop a business case for training and show how you can drive maintenance and reliability efficiency.

By Adrian Messer

In spite of a threatening economic recession, many key outlets indicate a resurgence of industrial manufacturing back to the United States. The weaknesses in a lean global supply chain that were exposed during the pandemic are

slowly being dealt with. The latest data from the Reshoring Initiative show that reshoring jobs plus increases in foreign domestic investment are 15% above the first quarter of 2022, which is the highest rate ever recorded (see Figure 1).

FIGURE 1
JOB ANNOUNCEMENTS PER YEAR, RESHORING + FDI, 2010 THRU 2022 PROJECTED

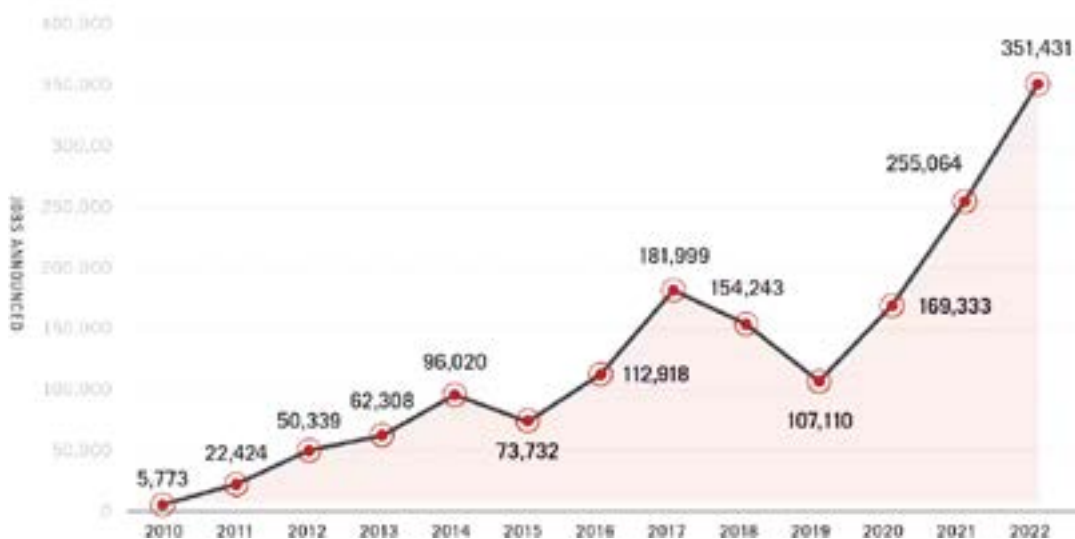


Figure 1: From the Reshoring Initiative, this data shows that job reshoring and foreign domestic investment are at an all-time high.

With new manufacturing jobs coming back to the U.S., some industry sectors are facing layoffs and cutbacks. So, if you're in a situation where you're faced with doing more with less, at least ensure that your staff is trained up to their expected ability. If the work that they are to perform is held to a certain standard, then the instructions and procedures that they are given should be written to the same standard. Proper training, combined with thorough work instructions and procedures, can help drive the effectiveness and efficiency of your maintenance and reliability team.

BUILDING A BUSINESS CASE

If you're trying to sell the need for additional training to your decision makers, it may help to create a business case. A business case is really just a form of a gap analysis. It should describe (1) your issue, (2) the current status, and (3) the desired results. The results desired should be centered around your organization's goals and objectives: how reliability will be improved, if there are any safety issues that can be avoided because of having the training, and how any possible product and efficiency improvements can be gained.

Your problem statement should be concise and specific, keeping to no more than one paragraph. For background information, include specific information regarding cost and budgeting, as well as what would

be required to resolve the skills deficiency that the training will address. Also describe the current situation, and again mention specifics such as results from a skills gap analysis, or a change in equipment or assets where needed skills and experience will help to maintain and troubleshoot the new equipment. Consider using metrics such as Mean Time To Repair (MTTR) as a way to identify what skills or training may be necessary.

For estimating costs for budgeting purposes, consider using the Maintenance Training Cost metric, which is commonly represented as a percentage of the employee's annual wage. The metric was developed to determine what the industry standard is for how much training maintenance employees are to receive per year. Since this metric varies due to annual wage, the range can be between 1.65% to 4.4%. Another possible metric to use is training hours per maintenance employee, and best-in-class is 80 hours per employee per year.

Ensure that you have stated your current process, and how current processes and lack of skills needed is affecting any production, reliability, or even quality related issues. List any requirements and resources that will be needed for the training. If there's one thing that the pandemic pushed forward, it's online training. Many vendors pivoted to online

training, and there are some very nicely done online training options available now, that are both interactive and blended with a live instructor. However, if online training is not an option, be sure to state that in your business case.

If there are any alternatives, compare and contrast alternatives in your business case including any differences, advantages, and any associated (or extra) costs with each one. Be sure to use language and terminology that is applicable to your specific facility and industry. Consider working with both internal and external resources to gather information on any industry specific benchmarks; these could include what other companies are doing for training in your geographic region, as well as what resources could be available from your local community or technical colleges.

Finally, what's the ROI? Including ROI information in your proposal for training is going to be key when presenting it to the decision makers. If the training can improve the safety of those performing the work or the surrounding environment, there should be no questions asked. Factors that contribute to your maintenance training ROI would be the added business benefits compared to the costs associated with the training. Don't forget about the current resources within your own organization. Many companies have folks with years of experience that might be willing to help

to impart that knowledge to others. Take advantage of those human resources before they are lost to retirement.

About the Author:

Adrian Messer has worked in the maintenance and reliability field for nearly 20 years. During that time, he has worked with manufacturing and distribution facilities across multiple industries helping to improve their plant's asset reliability through improved condition monitoring. As Vice President of Executive Services at Progressive Reliability, Adrian has a focus on working with companies to help them find and place high level maintenance and reliability professionals with jobs that are the right fit based off of their needs, wants, and qualifications. In addition to identifying and vetting maintenance and reliability talent, he also advises companies when they have a need for a subject matter expert to work with them on a contract basis for special reliability focused projects.

Adrian is a graduate of Clemson University with a Bachelor of Science in Management with a concentration in Human Resources. He is a Certified Maintenance and Reliability Professional (CMRP) through the Society for Maintenance and Reliability Professionals (SMRP) and is actively involved with SMRP on a local and National level. He resides in Anderson, South Carolina.