KEY PERFORMANCE INDICATORS

BY: **RICKY SMITH, CMRP, CMRT, CRL**

UpKeep

WORLD CLASS MAINTENANCE

GIVING BACK TO MOVE MAINTENANCE FORWARD

TMCC
THE MAINTENANCE COMMUNITY COALITION

upkeep.org

Key Performance Indicators
By Ricky Smith CMRP, CMRT

When identified and aligned properly, key performance indicators (KPIs) can save a plant, a job, a career. If management truly understood the power of KPIs, things would change quickly. In fact, managing without KPIs gives one the feeling of being lost with no hope (a reactive environment).

Think of a car with the windshield painted black. The driver cannot see where the car is going but has a glimpse of where it has been, through the rearview mirror. The driver cannot tell if the trip is successful or not until either it's too late—or disaster strikes. The car could go into the ditch (high cost or worse) or never reach the destination (business goals not met). So, too, for a company blind to KPIs.

This is a serious problem, and it costs companies around the world billions of dollars as a result of what, we consider, a lack of management control. *Peter Drucker, the industrial revolutionary, stated: "You cannot manage something you cannot control, and you cannot control something you cannot measure."*

DEFINING AND UNDERSTANDING KPIs

Let us first get down to basics and define KPIs. Within maintenance, we first define the performance we want to measure.
1. Is it the performance of the equipment?
2. Is it the performance of the spare parts warehouse?
3. Is it the performance of the maintenance function?

This may seem like a simple question, but often I see companies that do not understand their KPIs as they have not defined the specific area of business for which the performance is being measured.

Assume we want to measure the performance of the maintenance function. One of two kinds of KPIs must be chosen for measuring any particular function of a business: leading indicators or lagging indicators (also referred here as *leading* and *lagging KPIs*). Leading KPIs lead to results, such as scheduled compliance; lagging KPIs are the results, such as maintenance cost (effected if scheduling is not working).

We use leading indicators to manage a part of the business, while lagging indicators measure how well we have managed. With leading indicators, therefore, it is possible to directly and immediately respond when a poor result is found. With lagging indicators, we get value from knowing how well we performed but have little opportunity to immediately affect underperformance.

Instead, when we see an unacceptable lagging indicator, we typically must drill down to the leading indicators to uncover the cause of the underperformance and from there, we can implement appropriate changes.

Leading indicators for the maintenance function are those that measure how well we conduct each of the steps in the maintenance process. For example, a leading indicator for the work planning element of maintenance process could be the percentage of planned jobs executed using the specified amount of labor.

If the planner is estimating labor correctly, we see a high percentage of jobs completed using the planned amount of labor hours. A maintenance manager who finds that the value of the KPI is lower than expected can speak with the planner about how best to improve the results immediately, possibly for the remainder of that day. With all KPIs, by definition, we measure past performance, so we do not suggest that leading indicators can be tweaked to improve past performance. But, if we are managing using leading indicators, we can respond immediately when needed.

THE BASICS OF MAINTENANCE AND RELIABILITY

So leading indicators measure how well we perform our jobs, while lagging indicators measure results. We manage using leading indicators, and we react to results using lagging indicators.

In the maintenance example, a lagging indicator measures the results of how well we managed the maintenance function. In a situation where the maintenance function is well managed, we expect an appropriate balance between the cost of maintenance and the plant availability. A lagging indicator therefore could be the actual maintenance cost for a month, as a percentage of the budgeted maintenance cost for that month.

If the actual maintenance cost for last month is found to be 110% of budget, we can do very little to directly influence the performance of this KPI today. Instead, we look at all the leading indicators, probably including those that measure the performance of the maintenance process, to determine whether those values give us a signal for managing the problem.

Unfortunately, in the quest for excellence, we often are attracted to outside consultants that offer "benchmarking" services, claiming to provide all the KPIs we need to effectively run the business. Be careful, when considering these services, that you are not signing up for a laundry list of lagging indicators, since they will not help you with managing; they'll just quantify the problem you already acknowledged when you sought outside help.

Figure 6.1 shows how leading indicators for the maintenance process can provide Management capability, while the lagging indicators show us how well we managed the maintenance function.

Key Performance Indicators   91

TABLE 6.1. Specific Examples of Leading and Lagging Indicators

| KPI Type	Measure	Key Performance Indicator	World Class Target Level
Result/lagging	Cost	Maintenance cost	Context specific
Result/lagging	Cost	Maintenance cost/replacement asset value of plant and equipment	2–3%
Result/lagging	Cost	Maintenance cost/manufacturing cost	<10–15%
Result/lagging	Cost	Maintenance cost/unit output	Context specific
Result/lagging	Cost	Maintenance cost/total sales	6–8%
Result/lagging	Failures	Mean time between failure	Context specific
Result/lagging	Failures	Failure frequency	Context specific
Result/lagging	Downtime	Unscheduled maintenance related downtime (hours)	Context specific
Result/lagging	Downtime	Scheduled maintenance related downtime (hours)	Context specific
Result/lagging	Downtime	Maintenance related shutdown overrun (hours)	Context specific
Process/leading	Maintenance strategy	Percentage of work requests in "request" status for less than 5 days, over the specified time period	80% of all work requests should be processed in 5 days or less
Process/leading Planning element/lagging	Planning	Percentage of work orders with work-hour estimates within 10% of actual, over the specified time period.	Accuracy of greater than 90%
Process/leading	Planning	Percentage of work orders, over the specified time period, with all planning fields completed	95% +
Process/leading	Planning	Percentage of work orders assigned "rework" status (due to a need for additional planning) over the last month.	Should not exceed 2–3%
Process/leading	Planning	Percenage of work orders in "new" or "planning" status less than 5 days, over the last month	80% of all work orders should be possible to process in 5 days or less; some work orders require more time to plan but attention must be paid to late finish date
Process/leading Scheduling element/lagging	Scheduling	Percentage of work orders, over the specified time period, having a scheduled date earlier or equal to the late finish or required by date	95%+ should be expected to ensure the majority of work orders are completed before their late finish date
Process/leading	Scheduling	Percentage of scheduled available work hours to total available over the specified time period	Target 80% of work hours applied to scheduled work
Process/leading	Scheduling	Percentage of work orders assigned "delay" status due to unavailability of personnel, equipment, space, or services over the specified time period	Number should not exceed 3–5%
Process/leading	Execution	Percentage of work orders completed during the schedule period before the late finish or required-by date	Schedule compliance of 90%+ should be achieved
Process/leading Execution element/lagging	Execution	Percentage of maintenance work orders requiring rework	Rework should be less than 3%
Process/leading	Follow up	Percentage of work orders closed within 3 days, over the specified time period	Should achieve 95%+; expectation is that work orders are reviewed and closed promptly

Leading indicators such as Percent of Rework and Percent of PMs Executed on Time affects the overall performance of the maintenance process, which results in a certain level of performance.

The lagging indicators in this case, which are affected by these leading indicators, are Maintenance Cost as a Percent of Budget and Plant Availability. At least one of these lagging indicators will suffer if there is sufficient underperformance in the leading indicators. This example shows the alignment of the maintenance process as KPIs transition from leading to lagging.

Figure 6.1 does not show the specific KPIs used to manage the maintenance process. Instead, some of those are listed in Table 6.1, along with the world-class target level, where applicable.

In the same way as in the maintenance example, KPIs can be used in other areas of the business. This approach is particularly interesting where multiple functional areas play roles in each goal, such as plant reliability. Plant reliability is a shared responsibility of the maintenance, production, and engineering. Leading indicators for each departmental process would feed the lagging indicators for the department function, which would then summarize to the plant level, as shown in Figure 6. 2.
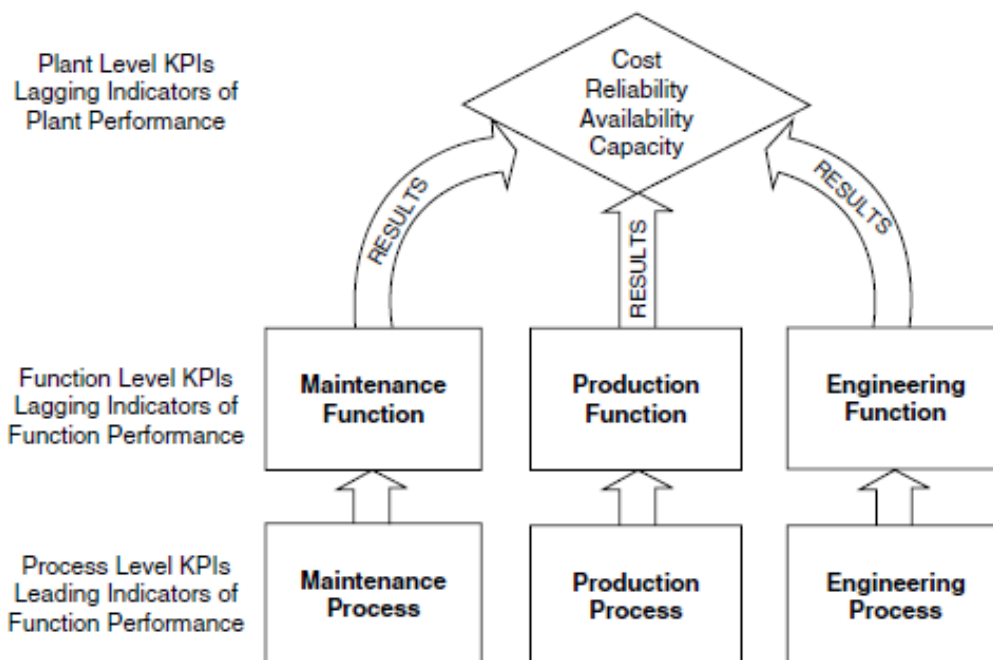
FIGURE 6.2. The use of leading and lagging indicators across functional areas.

THE PROBLEM

The problem is that management should learn to manage operations through KPIs (both leading and lagging). In over 30 years, we have seen many plants shut their doors forever. The closings were blamed on many reasons, but the one thing all had in common was that *none* had properly managed with the KPIs. The metrics or indicators they managed with were ones like:
1. Cost
2. Asset Availability
3. Equipment Downtime
4. Overall equipment effectiveness.
All these measurements or indicators, while useful for measuring performance, cannot be used to manage the maintenance and reliability process. They are simply the results of all the previous actions in the maintenance and reliability process. Again, one cannot manage results. One can manage only the processes leading to the results. A company that uses any of these metrics to manage its operation, without leading indicators, is in a reactive mode.

Companies must ask themselves some very basic questions:

1. Does the company differentiate between those KPIs that can be used to manage (leading indicators) from those that measure results (lagging indicators)?
2. Does the company measure the performance of the maintenance process, which it easily can manage when needed?
If leading indicators show underperformance, then that underperformance will affect the lagging indicator, which could be reliability, cost, capacity, and the like. People must understand the relationship between a leading and lagging indicator and their effects on the maintenance and reliability function.
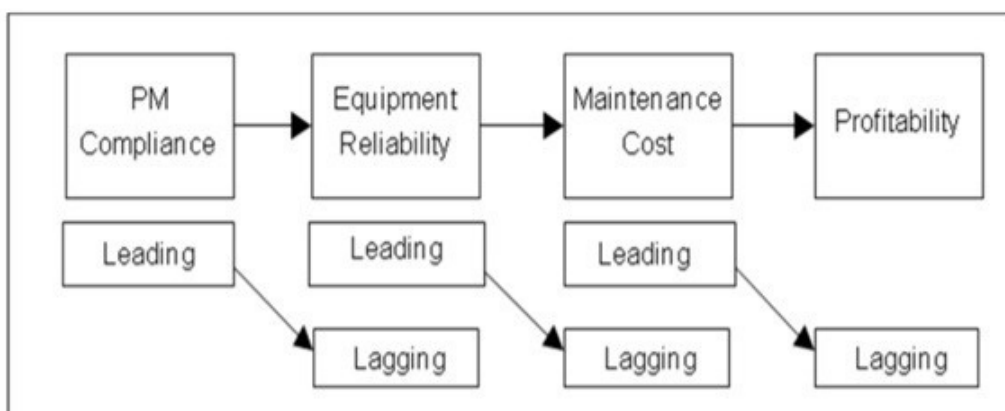
UpKeep

#1 Software for Maintenance & Reliability Teams

UpKeep is a service-first company that builds software designed to make maintenance easier for technicians and managers everywhere. Reduce downtime up to 18% by switching over to a preventative maintenance solution!

www.upkeep.com

Our Products

UpKeep

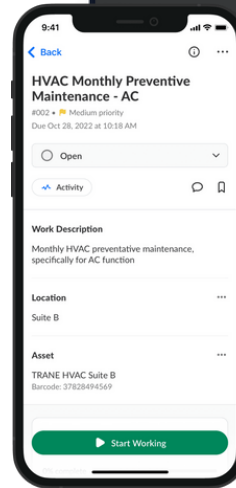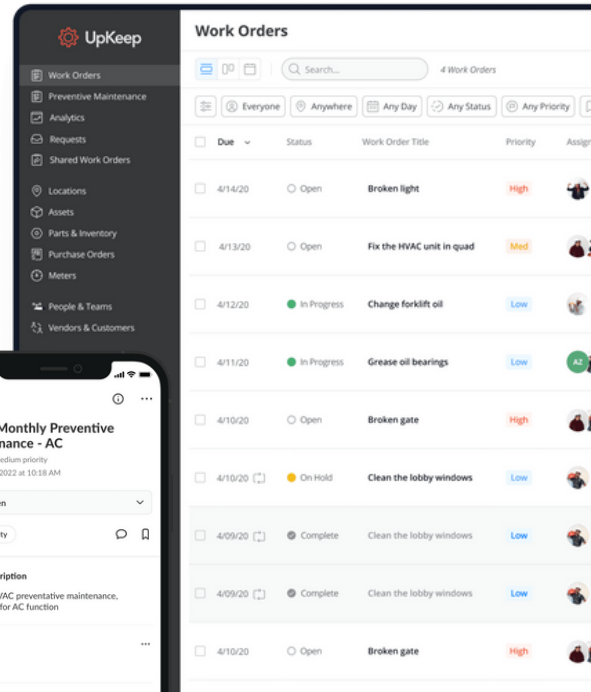## Mobile-first maintenance management and collaboration across all location, assets, and teams

With nearly 340 different machines in our work environment, it's an impossible task to manually assign and track PM's. **With UpKeep we can schedule regular maintenance without overlapping tasks with other critical jobs."**

★★★★★   **Paul D, Health and Safety Coordinator**

An end-to-end solution for remote condition-based monitoring

Connected and secure IoT sensors for real-time remote condition asset monitoring

edge
by UpKeep

Integrated & Centralized Data Ecosystem for World Class Asset Operations

The only purpose built Asset Data Platform. Asset Focused ELT Solution for advanced analytics and integrated, real-time asset data.

DATAHUB
UpKeep

The Maintenance Community Coalition was founded on the belief that working together will benefit everyone within our community

Committed to helping each other thrive in our individual professional journeys by sharing resources and expertise, granting scholarships, hosting events, and unlocking knowledge – always at no cost.

TMCC
THE MAINTENANCE COMMUNITY COALITION