

Key Performance Indicators - Leading or Lagging and When to Use Them – *Author – Ricky Smith*

Initiating major change, such as moving from a reactive maintenance operation to one which is proactive and employs Best Maintenance Practices to achieve Maintenance Excellence™, requires start-up support from top management. In order to continue the journey towards Maintenance Excellence, the continued support from management will need justification. Upper management will not be satisfied with statements like “just wait until next year when you see all the benefits of this effort.” They will want something a little more tangible if you are to gain further commitment from them. You will need to provide tangible evidence in the form of objective performance facts.

That’s where metrics comes in. **Metrics** is just a term meaning “to measure” (either a *process* or a *result*). Combining several metrics yields **indicators**, which serve to highlight some condition or highlight a question that we need an answer to. **Key Performance Indicators (KPI)** combine several metrics and indicators to yield objective performance facts. They provide an assessment of critical parameters or key processes. KPI for maintenance effectiveness have been discussed, defined and refined for as long as proactive maintenance has been around. KPI combine key metrics and indicators to measure maintenance performance in many areas.

Metrics can be a two-edged sword. Metrics are essential for establishing goals and measuring performance. Metrics chosen or combined erroneously can produce misleading indicators that yield incorrect and/or low performance measures. Inaccurate measures produce bad management decisions.

If you are involved in an equipment improvement program, such as Maintenance Excellence, you must have a thorough understanding of the financial metrics used by your company to measure results and track improvement. You will need to establish a direct link between improved equipment reliability and overall company operational performance. At the bottom line, your metrics must yield a KPI in terms of financial performance.

To determine maintenance strengths and weaknesses, KPI should be broken down into those areas for which you need to know the performance levels. In maintenance these are areas such as preventive maintenance, materials management process, planning and scheduling, and so on until two major Maintenance Department KPIs are defined:

- ✓ Maintenance Department Operating Costs (Budget Performance)
- ✓ Equipment Reliability

In turn, equipment reliability must correlate to production – both production vs. capacity and cost per unit produced. On the other hand, operating costs must be carefully considered. Initiating change is going to initially increase maintenance department expenses. Accurately forecasting a budget centered on change is essential if KPI is going to accurately depict department budget performance. (See Figure 1)

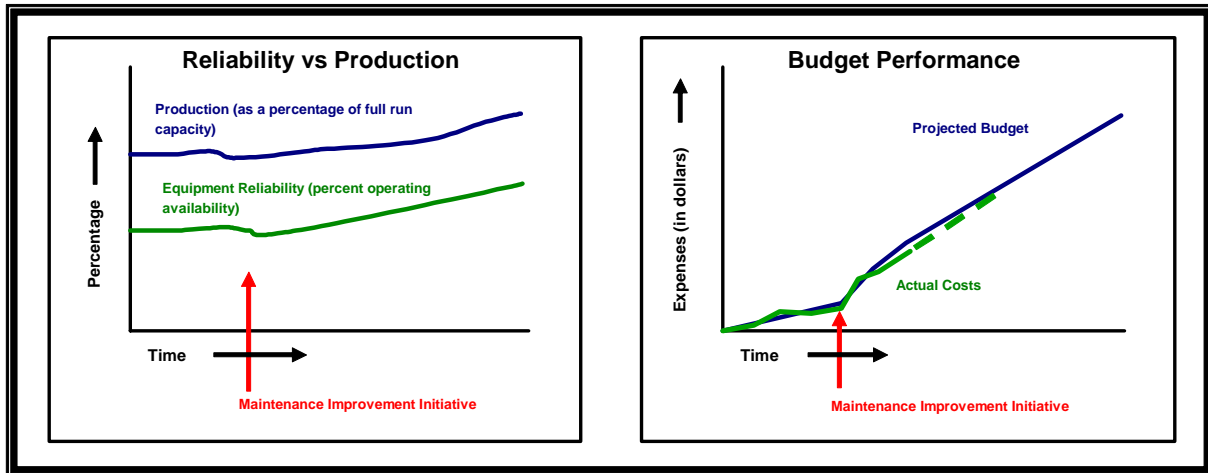


FIGURE 1

Depending on KPI values we classify them as either **leading** or **lagging** indicators. Leading indicators are metrics that are task specific. They respond faster than results metrics and are selected to indicate progress towards long term objectives. Leading indicators are indicators that measure and track performance before a problem arises. To illustrate this, think of a key performance indicators as yourself driving a car down a road. As you drive, you deviate from the driving lane and veer onto the shoulder of the road. The tires running over the “out of lane” indicators (typically a rough or ‘corrugated’ section of pavement at the side of the road that serves to alert you to return to the driving lane before you veer completely off the pavement onto the shoulder of the road). These “out of lane” indicators are the KPI that you approaching a critical condition or problem. Your action is to correct your steering to bring you car back into the driving lane before you go off the road (**proactive condition**).

If you did not have the indicators on the pavement edge, you would not be alerted to the impending crisis and you could veer so far out of the driving lane that you end up in the ditch. The condition of you car, sharply listing on the slope of the ditch, is a lagging indicator. Now you must call a wrecker to get you out of the ditch (**reactive condition**). Lagging indicators, such as your budget, yield reliability issues, which will result in capacity issues.

The necessity for tracking KPI other than just Equipment Reliability and Budget Performance is to pinpoint areas responsible for negative trends (leading indicators). You would not want to scrap your Maintenance Excellence initiative when the only problem is that the Planner / Scheduler didn’t receive adequate training. By observing and tracking Planned / Schedule Compliance and Planned Work as a percentage of total labor you should be able to detect “non-improving” or even negative performance early enough to identify and correct the training problem. The “lower tier” leading indicators are also necessary for establishing benchmarks (Best Maintenance Practices) and tracking departmental progress. For example, the benchmark for the KPI “Planned / Schedule Compliance” is generally accepted as 90%. The tracking and public display of positive leading KPI also provides significant motivational stimuli for maintenance department personnel.

A manager must know if his department is squarely in the driving lane and that everything is under control, as long as possible before it approaches and goes into the ditch. A list of some of the key performance indicators of the leading variety are illustrated in Table 1. Note that some of these indicators could be both leading and lagging when combined with and applied to other KPIs (Key Performance Indicators).

TABLE 1

Key Performance Indicators	
<p>Reliability/Maintainability</p> <ul style="list-style-type: none"> ➤ MTBF (mean time between failures) by total operation and by area and then by equipment. ➤ MTTR (mean time to repair) maintainability of individual equipment. ➤ MTBR (mean time between repairs) equals MTBF minus MTTR ➤ OEE (overall equipment effectiveness) Availability x Efficiency (slow speed) x Quality (all as a percentage) <p>Preventive Maintenance (includes predictive maintenance)</p> <ul style="list-style-type: none"> ➤ PPM labor hrs. divided by Emergency labor hrs. ➤ PPM WOs (work orders) #s divided by CM (corrective maintenance, planned/scheduled work) WOs as a result of PM inspections <p>Planning and Scheduling</p> <ul style="list-style-type: none"> ➤ Planned / Schedule Compliance – (all maintenance labor hours for all work must be covered and not by “blanket work orders”) this a percentage of all labor hours actually completed to schedule divided by the total maintenance labor hours. ➤ Planned work – a % of total labor hours planned divided by total labor hours in scheduled. 	<p>Materials Management</p> <ul style="list-style-type: none"> ➤ Stores Service Level (% of stock outs) – Times a person comes to check out a part and receives a stock part divided by the number of times a person comes to the storeroom to check out a stocked part and the part is not available. ➤ Inventory Accuracy as a percentage <p>Skills Training (NOTE: A manager must notify maintenance craft personnel about the measurement of success of skills training)</p> <ul style="list-style-type: none"> ➤ MTBF ➤ Parts Usage – this is based on a specific area of training such as bearings <p>Maintenance Supervision</p> <ul style="list-style-type: none"> ➤ Maintenance Control – a % of unplanned labor hours divided by total labor hours ➤ Crew efficiency – a % of the actual hours completed on scheduled work divided by the estimated time ➤ Work Order (WO) Discipline – the % of labor accounted for on WOs. <p>Work Process Productivity</p> <ul style="list-style-type: none"> ➤ Maintenance costs divided by net asset value. ➤ Total cost per unit produced ➤ Overtime hours as % of total labor hours

NOTE: KPIs must answer questions that you as a manager ask in order to control your maintenance process. Listed is a sampling of recommended KPIs. They are listed by the areas in which a maintenance manager must ask questions

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