

## Performance Indicators – what you need to know...



**Paul Dean**  
Shire Systems Limited

**Abstract**

**Business-led, results-orientated maintenance management is driven by Key Performance Indicators (KPIs), also known as measures or metrics. There are two types of indicators – lagging and leading. Success as an engineering manager depends on understanding the basic nature and use of each type – together with a resolute bias for action.**

### INTRODUCTION

In manufacturing, processing and other equipment-intensive organisations, plant reliability, process capability, people safety and profitability all depend on the right actions of the engineering manager and his or her team. These individuals are responsible for delivering the required good order in the most economical way. The competitiveness of the business hinges on their efforts. The challenge is onerous. In order to deliver, the engineering manager is obliged to implement a data-driven, results-orientated performance management system based on the 'DMAIC' cycle – viz. Define, Measure, Analyse, Improve and Control. Well-selected performance indicators provide the vital means of control and continuous improvement; ultimate success is dependant on their use.

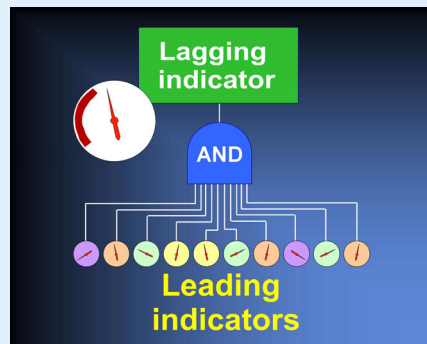
Before reading on, please consider this example: Mean Time Between Failure (MTBF) is a lagging indicator, whereas Preventive Maintenance (PM) Performance, for instance, is one of many associated leading indicators - both are Key Performance Indicators (KPIs). The nature of the relationship between lagging and leading indicators dictates that in order to be good in the first one you must initially excel at most of the second ones. This is the stumbling block for the unwary.

### LEADING CAUSES BEGET LAGGING EFFECTS

Lagging indicators are historical, quantified, statements of fact; they measure 'outcomes', that is, results achieved. Accordingly, they are backward-looking.

They also respond quite slowly to changes made in the workplace. Leading indicators, on the other hand, are forward-looking and predictive of a desired future state; they measure the 'inputs' that ultimately determine the outcomes. Leading indicators have a much faster response to associated changes made in the workplace.

Every lagging indicator, of maintenance or otherwise, has a related set of driving influences. Many of these will be common knowledge but can otherwise be deduced by logical analysis. Each influence can be 'measured' by a leading indicator quantifying its specific performance achievement. The direct correlation between the inputs and outcomes means the relationship between associated leading and lagging indicators is one of simple cause-and-effect. In other words, well-chosen leading indicators are the essential means to the end defined by their associated lagging indicator.



Lagging indicators follow the trend of associated leading indicators with a significant time delay. This is advantageous; the in-built delay provides space to reflect on progress, adjust emphasis and take definitive action. Interventions to improve leading indicator performance are legitimately categorised as preventive or improvement actions – not knee-jerks!

Without the essential aid of an appropriate set of leading indicators, you will not be able to prevent plant and process failures or properly action improvements. Your actions will not only be reactive, you will be thrashing around in the dark; all to the detriment of the business. Trying to control and improve maintenance activities using lagging indicators alone is futile because it places vain hope in after-the-fact guesswork. You could get lucky with the knee-jerks, but trial and error is not the smartest way to proceed.

### THE DEVIL IS IN THE DETAIL

No management concern or problem can ever be resolved in general, only in detail. This is one of the first rules of situation analysis. The challenges you face in the

workplace are invariably cans of worms. To tackle them, you first have to unravel their complexity, drilling down to the detail. Big, multi-faceted issues have to be broken down and separated into their fundamental elements. It is only by homing in on these single addressable elements that you can resolve the bigger problem. The devil is always in the detail.

Lagging maintenance indicators quantify the top level, strategic goals – the primary maintenance outcomes contributing most substantially to a business's success or shortcomings. Two of the primary lagging maintenance indicators are Mean Time Between Failure (MTBF) and Mean Time To Repair (MTTR). These factors are the undisputed drivers of Uptime, Availability and Overall Equipment Effectiveness (OEE). Other important examples are Service Level Agreement (SLA) compliance and Incident Frequency. While these are among the foremost factors to track, there are tens of others you can choose from to augment them.

When you do maintenance 'right', you will hit the strategic numbers management is looking for – and maybe get a pat on the back. Doing the 'right things' is effectiveness and doing the 'right things right' is efficiency. Effectiveness is paramount! You must always be effective; whereas efficiency is something you continually strive for and improve over time. A simple premise that is so often ignored.

The problem with lagging indicators is that they don't actually measure the multiplicity of things you have to do 'right' on the day – and day after day – in order to achieve the strategic results you are aiming for. Because the devil is in the detail, and lagging indicators do not focus on the detail of *what* and *how* on the ground, they are practically useless for controlling the real-time activities of maintenance. For that you need leading indicators.

If you report lagging indicator performance – say MTBF – to the powers that be in your organisation without first having your own success-enabling leading indicator framework in place, you will be making a rod for your own back.

### ALIGN MAINTENANCE WITH BUSINESS NEEDS

Your boss and your customers have performance needs and expectations; these can sometimes be fuzzy. It is logical that concrete goals should be established. The way to do this is to agree the headline lagging maintenance indicators that best apply to current aspirations and circumstances. In manufacturing, Availability and other OEE influences will figure, along with their drivers: MTBF and MTTR. In services, contractual SLA measures will be king. Performance targets must be set for each lagging indicator you decide on.

The ball is then in the engineering manager's court. You must get down to the job of delivering the required performance on the ground. Although any business-led, performance improvement, initiative should be driven from the top, the inputs and

direction for the maintenance contribution must come from the engineering manager. As an engineering professional you know the issues and dynamics of the maintenance process. As maintenance leader, it is for you to drive the change.

When the lead is not taken by the engineering manager the top-down emphasis is very likely to be accounting-led. This is disastrous! Maintenance is a service to production and, on the list of management priorities, production cost savings rank above those of maintenance. Effectiveness being paramount, the main focus should be on equipment uptime and reliability improvement, not maintenance cost reduction. Maintenance costs are certainly important but a prime emphasis on maintenance cost-cutting will not translate into the business performance actually being sought. On the other hand, investing in reliability improvement carries with it the promise that costs will automatically reduce as a result – along with improvements in product quality, production capacity and people safety. It is the job of the engineering manager to make his boss aware of the difference, the potential pay-off that is up for grabs and how it can be achieved using leading indicators.

## LEADING THE WAY

Leading indicators are the magic means of performance delivery. After the headline lagging indicator targets have been agreed, the next step on the way to results-orientated maintenance is to select the leading indicators that will drive the required performance in the workplace.

Deciding what to measure requires deep reflection on the current situation. You have to map the cause-and-effect connections between business needs and the detailed activities of the engineering team. What should you be doing and how well should you be doing it? What must you stop doing? Aim to come up with two sets of objectives with polar opposite timelines. The first one should define the big vision and stretch goals – your medium term aspirations. Identify the critical few things to focus on, discarding the trivial many. The second, derived from the first, is all about expediency and energy – what you can reasonably do right now to press on and achieve the quickest gains. The first small but sure steps on the road towards achieving your big goals.

The right measures are context-specific and contemporaneous; they are of the moment. Home in on the most potent ones, remembering you are out to nail hard, short-term, objectives, not pursue a misty-eyed ideal – such as a poorly-defined TPM or RCM initiative. Choice will be driven by business targets but limited by your current capability, not least the maturity of your maintenance management process.

In your deliberations be guided by industry standards and measures. Use these as beacons to guide you, and as yardsticks to compare yourself against. This will be discussed later. Reach for the stars in your long term vision, but the immediate targets

must be realistic and achievable, so that they excite interest and elicit the continuing commitment of your team. Sit down with that team and agree the leading indicators and set the bite-size, short term objectives for each.

A good leading indicator has many desirable characteristics, of which the following are probably the most important –

- **Simple and unambiguous. Measures only one thing.**
- **Understandable and accepted by users.**
- **Sensitive to changes in work practice.**
- **Economical in data collection.**

Above all, a good leading indicator drives appropriate action. Leading indicators are used to identify trends; they are not pass-fail monitors. You will have good days and bad days, so an improving batting average is what you are aiming for with each of your selected indicators. Leading indicators measure and express in quantified terms what is happening on the ground – they keep a tally. They tell you if you are getting better or worse and help you decide what is working, what is not, and what, who and where to push to get your next incremental win.



## ABSOLUTE FOCUS ON THE TASK IN HAND

Lagging indicators are like the trackside scoreboard at a motor racing circuit. The scoreboard displays track positions, lap times, speeds, and so on. It's good for keeping spectators and commentators informed – and handy for drivers, especially the losers, to reflect on after the race. But that's it. During a motor race, the leader is not looking



backwards or sideways at the scoreboard; he is totally focused on the track ahead and the task in hand, hyper-conscious of the information being fed back from his car's real-time dashboard display. This presents

the leading indicators directly influencing his race performance.

The car's dashboard array alerts of any developing problem – with oil pressure, water temperature and so forth. In a Formula 1 car, the dashboard also feeds back up-to-the-minute information on driver performance, compared with the previous lap, on successive sectors of the track. And there are blinking red-green-blue gear-shift advice lights which enable the driver to time his actions to perfection. Real-time detail is what's important for driver success.

Formula 1 team philosophy in respect of the dashboard display is: *'all the information the driver needs and nothing more'*. So, there is no speedometer. To realise the potential of the car and win the race, the driver has to constantly push his speed to the limit. All things being equal, the driver's competence, confidence and commitment determine the speed; a speedometer is an unnecessary distraction.

There are parallels to draw in maintenance for the engineering and service manager. To realise the innate potential of the equipment and facilities in your care,

and of your crew, you must be hands-on, fully engaged and precisely informed. You need clear forward visibility and an array of in-the-face, up-to-the-minute information to guide you. You need real time detail. Arguably this is only achievable using a Computerised Maintenance Management System (CMMS). A well-configured system will provide you with these essentials in a superbly interactive way.

You should set up your information system to monitor two sets of indicators: a leading set on a dashboard and a lagging set on your scoreboard. You can focus on the dashboard while keeping an eye on – but not distracted by – the scoreboard. The first will tell you how you are doing and the second will tell you, and inevitably your boss and others, how you have done.

## TOTAL SYSTEM OVERVIEW

Maintenance management in any sector is a complex business process with many discrete, yet interdependent, sub-processes and activities. One thing influences another; some things will be so intertwined that it may be impossible to separate cause and effect. To have any chance of satisfying your lagging indicator targets you need a composite set of leading indicators targeting vital aspects across the board. To gain a total system overview, all maintenance management's sub-processes have to be considered including –

- ♦ **Preventive maintenance**
- ♦ **Condition-based maintenance**
- ♦ **Corrective maintenance**
- ♦ **Emergency maintenance**
- ♦ **Planning and scheduling**

- ◆ Work control
- ◆ Materials management
- ◆ Failure analysis
- ◆ Plant modifications

But it is detail that matters. Within these processes there are local issues of pressing importance that you have to filter out. What is most important to you in a particular location at the present time? You cannot do everything at once; you have to prioritise where your attention is to be focused. For example, you may be concerned about the incidence of first-fix success, overdue maintenance tasks, temporary repairs, or safety incidents caused by faulty equipment. Maybe you want to drive up the number of assets subject to PM, cut the response time for emergency calls, push up the number of modifications being carried out, or reduce the average length of plant outages. The time and attention you can give to each issue on the ground is finite. Choose too many issues to focus on at one time and you will achieve little and may even sink the whole initiative.

Your leading indicators should be monitored in aggregate, like the set of instruments and annunciators on a car's dashboard. So, configure your leading indicator dashboard to display everything you need to keep an eye on and monitor repeatedly, if not constantly (i.e. all the information you need, and nothing more), so that you can perform confidently and effectively to achieve your targets.

In the hectic world of maintenance management, there is arguably nothing more important than the Work Order management system. It is an engineering manager's window on the world, so whatever else is being tracked Work Order statistics should be monitored and trended as a matter of routine. For instance the percentage of Work Orders awaiting approval, scheduling, sign off, etc.; the percentage of Work Orders on hold - awaiting materials or information; the work backlog percentage, etc. Note that while backlog is a work volume measure, it is fundamentally a reliability measure – high or increasing backlog unquestionably indicates poor plant reliability.

## BEST PRACTICE MAKES PERFECT

A leading indicator is task-specific. This makes it easy to comprehend by those carrying out the work. Each leading maintenance indicator is always associated with a maintenance best practice; the connection between the two is direct and clear cut. A leading indicator is a numerical expression of its associated best practice and provides a practical means of deploying and monitoring the best practice's implementation in the workplace. A lagging indicator, because of the many leading indicators driving it, quite clearly depends on an equivalent number of best practices. Because a lagging indicator is innately complex, it cannot be controlled except by divide and rule.

Exploit the learning curves of others! Look around for straightforward

examples of best practice you should be using. Benchmarking is the name given to this high-value cribbing activity. You can root out maintenance indicators and benchmark best practices from sources such as BSI 15341:2007, SMRP (The Society for Maintenance & Reliability Professionals – [www.smrp.org](http://www.smrp.org)), one of your sister companies, or an admired supply chain partner. The British Standard is exceptionally useful. Good provenance adds weight when you need to convince the powers that be in your organisation. And no matter how well you think you've got things figured out, when you can, it is always worthwhile to go along and observe how a target best practice is being carried out by others. There is invariably more to learn beneath the surface – that diabolical detail again!

In the days before KPIs came on the scene, an organisation's maintenance performance was judged by noting the presence or absence of known best practices. Nothing has really changed except that, with the use of computers, we are getting much smarter at measuring and putting a number on the results. It has become very easy to make objective comparisons between operating units and to track incremental improvements – or deteriorations - in their individual performance.

To reaffirm, don't focus on more than a handful or two of benchmark best practices at any time. The management time and attention that their implementation will inevitably consume is considerable. Your dashboard must balance the inherent complexity of maintenance management against your own time-bound capacity to assess, plan and co-ordinate activities. A maintenance performance improvement initiative is ultimately bottlenecked by the time, attention and energy that an engineering manager can give to it. The Working Time Directive has its good points!

## CMMS USE IS BEST PRACTICE

There are some practical preliminaries. Do you have the basics in place? If you are not presently respecting the principle of *'No work without a Work Order'* or, more importantly, *'All failure and 'job done' details to be recorded'* you are going nowhere. You are probably not even at the starting line with respect to your principal competitors.

To roll out a performance improvement initiative, you need a proper information



system. The framework and methodology cannot be implemented on the ground without the use of an enabling information tool. Practically, that means a CMMS. Performance management is complex and time is precious. A paper-based system will not do the job effectively or efficiently. The necessary data crunching can be done easily within the Work Order system of a CMMS. Performance management depends on accurate, timely and economical data collection and processing. A CMMS supports this with timesaving and mistake-proofing provisions, such as, rapid and systematised data-entry, built-in intelligence, mandatory fields, automated reports, etc. And CMMS usage itself has been affirmed as a maintenance best practice by British Standards and other standards organisations around the world.

## MEASURE TO ACT

It is what is actually happening at the coal face that really matters. Your real focus has to be on the practices and behaviours that are responsible for achieving the numbers. Numbers merely provide an indication of the extent to which the present focus is correct, or whether it should be altered to achieve the objective. Numbers serve as an affirmation or a warning. When the focus is primarily on the numbers themselves, they will be manipulated. As a result, the customer's perception of performance will not align with the statistics. 'What gets measured also gets manipulated' is a rule of human nature. It poses a particular challenge for governments!

Performance management is an iterative process. Objectives and their indicators must be kept under review. You should continually assess whether your current measures are still appropriate, sufficient or excessive. Are they proving useful and driving the organisation to the right result? Replace a measure when things have moved on and the underlying issue is no longer a concern. Drop a measure when there has been no change in its value, despite its associated process having received a lot of positive attention. Expediency rules the day.

It is no use measuring if you do not take action. That is a total waste of time. Collecting and logging performance data when you are not using it to be proactive just adds fruitlessly to operating costs. The only purpose of measurement is to trigger and guide appropriate action. Performance management demands a bias for action. It is essential that you never duck out of taking prompt controlling action in response to your measures.

Of course, you could still use the system as a history book – a collection of snapshots of past misadventures to reminisce over – or a rear-view mirror to see what has just gone by you. But living in the past is not competitive and your attention and focus should always be on the road ahead!

## SUSTAINING THE GAINS

Maintenance performance is ultimately determined by the practices in

use and, critically, the behaviour of those individuals applying them. These are the real determinants of maintenance success.



Your main concentration and effort as maintenance leader should therefore be on bedding-in and institutionalising your target best practices. That is, educating and guiding members of your crew and other contributors to ensure the necessary winning behaviours and to foster habits of excellence. Being able to see the results of input efforts directly reflected in the improving values of the leading indicators will drive commitment and enthusiasm in the workplace. On the other hand, trying to force change by exhortation is doomed to failure. Demanding that the maintenance crew achieve 80% OEE will just make eyes glaze over. Aside from

the leadership deficiency, OEE is a fuzzy and unrelatable lagging indicator, and a composite one to boot.

You may gain, but can never sustain, competitive maintenance and business performance without achieving the prerequisite level of competency in each contributory best practice. Competency has to become embedded within your organisation; ingrained discipline is what you are looking for. Going back to the car driving example: even with a fully informative dashboard of instruments and warning lights, some individuals still run out of fuel and even blow up their engines! Success is not assured without the necessary attentive, disciplined behaviour. That takes exceptionally good leadership to achieve.

But that's your job.

### LET'S GO!

The precursors of maintenance management success are generally well-known: maximisation of planned work, preventive maintenance, schedule compliance, failure analysis, ready availability of spare parts, operator maintenance, etc. – savvy individuals in the workplace can reel them off – and yet they are so often ignored. Better uptime, equipment reliability, process capability, costs, safety, profit and your own success as an engineering or services manager all depend on them. You may hope

and pray for a better future but, unless you take action today and start changing things, you will just face Groundhog Day tomorrow, next month and thereafter. Hope is not commitment and it is definitely not a method.

Nothing stands still in the world beyond your organisation. Out there, competition is rabid, thrusting and intensifying. Internal change is urgent. So don't get into prolonged navel-gazing about what should be done; just get on with it and begin breaking free from the status quo. With a bias for action, make a start; decide the best practices, set the targets and configure your indicator dashboard. Temporary and tentative indicators are OK until better ones emerge. Let's go! 🌟



[info@shiresystems.co.uk](mailto:info@shiresystems.co.uk)