Lean maintenance
using *measures* to boost performance

By Paul Dean, CEng
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This presentation is not particularly about CMMS. After all, CMMS is just a tool, albeit a very important one – for it’s the means by which maintenance professionals can secure success for their equipment-dependent organisations.

When we talk about craftsmanship, we tend not to focus on the tools used – we accept them as a necessity. Our real interest lies in aspects of a craftsman’s know-how and skill.

Accordingly, this presentation is principally about Maintenance Management and the role of the Engineering Manager – your role.
What will be covered

- Lean times ahead - Lean and the recession
- Where you, as Engineering Manager, fit in
- Maintenance cause and effect – the Cost-Value Syndrome
- Lean and TPM
- Before- and after-failure maintenance regimes
- The lagging and leading indicators of maintenance performance
- The big hitter performance indicators and practices
- Managing using ‘measures’
Lean times ahead
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- The manufacturers left standing will probably be the ones that have embraced Lean.
Lean times ahead

Daniel Jones, the UK High Priest of Lean, observes:

A recession is a good time for Lean. Organisations can either postpone Lean and resort to traditional cost cutting, or they can accelerate and redouble their progress with Lean. I doubt the former will last the course. But the latter stand a good chance of surviving and laying the foundations for future prosperity as they turn the tables on their competitors...
Lean times ahead

- Lean manufacturing initiatives are driven from the top. But they depend on maintenance transformation – and that’s *your* baby! You are the controlling mind
Lean times ahead

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- You are a maintenance professional. Above all, you are a leader. You must also be an innovator. You are closest to the action and it’s you that must drive maintenance change - if not you, who?
Lean times ahead

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- Ask yourself the question: Am I a true leader-innovator or a repair administrator?
You are **key**

- Never in your lifetime has there been a greater need for you to do more with less – the need to innovate
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- As an Engineering Manager, you hold the key to increased manufacturing performance – so ask yourself a second question **How fast am I making things better?**
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- As an Engineering Manager, you hold the key to increased manufacturing performance – so ask yourself a second question **How fast am I making things better?**
- Your organisation’s post recession survival depends on your answer to these acid test questions
Consider two companies producing the same product

One has healthy, reliable equipment…
Consider two companies producing the same product.

...the other has unhealthy, troublesome equipment.
Consider two companies producing the same product.

The company with the greater downtime faces the following **disadvantages**...
Disadvantages of unhealthy equipment

- More defects
- More overtime
- More material costs
- More overheads
- More shipping delays
- More standby plant – wasted capital - a bigger ‘hidden’ factory
- More health, safety and environmental violations and expense
Disadvantages of unhealthy equipment

- More defects
- More overtime
- More material costs
- More overheads
- More shipping delays
- More standby plant – wasted capital
  - a bigger ‘hidden’ factory
- More health, safety and environmental violations and expense

Which one will survive the recession?
Lean times ahead

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Lean times ahead

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- However, *lean manufacturing assumes that sufficient machine Availability already exists in the first place*
Lean times ahead

- Senior managers aspire to reap the rewards of Lean manufacture
- However, *lean manufacturing assumes that sufficient machine Availability already exists in the first place*
- Companies managing only 60 or 70% Availability during scheduled uptime CANNOT be Lean
Lean times ahead

- Many manufacturers still operate without applying best practice in maintenance management. Ipso facto, their achievable manufacturing performance is totally compromised.
Lean times ahead

- Many manufacturers still operate without applying best practice in maintenance management. Ipso facto, their *achievable manufacturing performance is totally compromised*

- Poor performance has its basis in a reactive, inept approach to maintenance – the *absence of planning*, coupled with *equipment abuse*
The maintenance cost iceberg

The cost-value syndrome
The maintenance cost iceberg

Most will be familiar with the concept of the ‘maintenance cost iceberg’
The maintenance cost iceberg

- Most will be familiar with the concept of the ‘maintenance cost iceberg’
- The Maintenance Department’s headcount and expenses make up the tip of the iceberg – the part seen by Management and onlookers
The maintenance cost iceberg

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- The Maintenance Department’s headcount and expenses make up the tip of the iceberg – the part seen by Management and onlookers

- But the bulk of the costs lie hidden beneath the surface and present a huge danger to unwary businesses…
The maintenance cost iceberg

- Often too detached from the workplace, Management can be infected with a penny-pinching, ‘bean-counting’ mentality

How much of an iceberg is seen above water?
The maintenance cost iceberg

- Often too detached from the workplace, Management can be infected with a penny-pinching, ‘bean-counting’ mentality.

- Too many are obsessed with cost cutting - rather than with ensuring resources are properly deployed to add value.

How much of an iceberg is seen above water?
The maintenance cost iceberg

- Maintenance is indeed a large element of the cost of manufacture - *the largest controllable cost*
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- But they’re there and they’re very real! The Maintenance Department does not exist in isolation.
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<10%

- (Non) Machine Availability
- (Non) Process Capability
- (Non) Regulatory Compliance
- (Inflated) Operating Costs
- (Wasted) Capital
The maintenance cost iceberg

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- But they’re there and they’re very real! The Maintenance Department does not exist in isolation.

The ‘hidden’ factory

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- (Non) Process Capability
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The maintenance cost iceberg

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- (Non) Process Capability
- (Non) Regulatory Compliance
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The maintenance cost iceberg

- Well-targeted, value-adding cost reduction - driven by you, the Engineering Manager - can decrease the overall mass of the maintenance cost iceberg...

Cost cutting is very different from value-adding cost saving
The maintenance cost iceberg

In the process, the ‘visible’ costs of maintenance will reduce automatically – by half, or more, in some cases. But, this saving is secondary compared to the more than 10-fold other gains realised in production, profit and competitive advantage.
**Beware! The iceberg gets bigger**

- A big problem lurks for Lean hopefuls who don’t keep up with the maintenance prerequisites
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- Gurus of Lean say that the downtime costs in a Lean-configured manufacturing cell are 5 to 30 times more than in other manufacturing environments - because of the direct and immediate losses kicking in along the manufacturing & supply chain.
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- Gurus of Lean say that the downtime costs in a Lean-configured manufacturing cell are 5 to 30 times more than in other manufacturing environments - because of the direct and immediate losses kicking in along the manufacturing & supply chain.
- The maintenance cost iceberg can become even more menacing!
Failure repair and prevention
Reactive and proactive maintenance
Reactive maintenance

- Most maintenance is carried out *after failure*
Reactive maintenance

Most maintenance is carried out *after failure*

Disruptive functional failures - *breakdowns* affecting production
Reactive maintenance

- Most maintenance is carried out *after failure*
- Traditionally, maintenance has been repair-oriented. 
  *Break it, then fix it.*
  Reasonable enough in Victorian times - *maybe* - but not now!
Reactive maintenance

- Most maintenance is carried out **after failure**

- Traditionally, maintenance has been repair-oriented. *Break it, then fix it.* Reasonable enough in Victorian times - *maybe* - but not now!

- This has resulted in a very harmful legacy predisposition – **aversion to planning**

Before failure  |  After failure
--- | ---
5 to 10% of work planned | 90 to 95% of work unplanned
Reactive maintenance

- Repair jobs performed after failure can cost 10 times more in terms of maintenance expense.

Before failure

After failure

5 to 10% of work planned

90 to 95% of work unplanned

failure
Reactive maintenance

- Repair jobs performed after failure can cost 10 times more in terms of maintenance expense.
- Unplanned jobs routinely take 3 times longer than a planned job - and equipment uptime and capability is lost into the bargain – another 10X factor hit!

Maintenance Costs

90 to 95% of work unplanned

5 to 10% of work planned

Before failure

After failure

failure
Reactive maintenance

- Repair jobs performed after failure can cost 10 times more in terms of maintenance expense.
- Unplanned jobs routinely take 3 times longer than a planned job - and equipment uptime and capability is lost into the bargain – another 10X factor hit!

The reason’s simple…
Throwing good money after bad

After a breakdown, the time to establish the facts and decide repair needs automatically increases due to:

- Confusion
- Non-availability of labour, materials, equipment and technical information
- The possible need to search out and cannibalise other plant
- When contractors and hired equipment are needed, the time and money wastage escalates
- When failure is catastrophic, the consequences of the collateral damage is anyone’s guess
Gambling with failure 🎲
The escalation of damage...
Gambling with failure
The escalation of damage...

From ‘So what?’ to...

‘What a catastrophe!’
Gambling with failure
The escalation of damage...

Speed loss, quality loss, minor stops, yield loss

Partial Failure
Gambling with failure

The escalation of damage...

- Speed loss
- Quality loss
- Minor stops
- Yield loss

Breakdown!
Production stops

Total Failure

Partial Failure
Gambling with failure
The escalation of damage...

Speed loss, quality loss, minor stops, yield loss

Breakdown!
Production stops

More expensive to fix Breakdown

Total Failure

Partial Failure

Total Failure with local collateral damage
Gambling with failure

The escalation of damage...

Speed loss, quality loss, minor stops, yield loss

Breakdown!
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More expensive to fix Breakdown

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Total Failure with catastrophic damage
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The escalation of damage...

Speed loss, quality loss, minor stops, yield loss

Partial Failure

Breakdown!
Production stops

Total Failure

More expensive to fix Breakdown.

Total Failure with local collateral damage

The sky is the limit for loss!

Total Failure with catastrophic damage
Gambling with failure

The escalation of damage...

- Speed loss, quality loss, minor stops, yield loss

Breakdown!
Production stops

- Total Failure with local collateral damage

More expensive to fix Breakdown

Total Failure

- Total Failure with catastrophic damage

The sky is the limit for loss!

The Engineering Manager is mainly responsible for these avoidable failures
Gambling with failure
The escalation of damage...

Speed loss, quality loss, minor stops, yield loss

Partial Failure

Breakdown!
Production stops

Total Failure

More expensive to fix Breakdown

Total Failure with local collateral damage

Senior management is responsible for these avoidable calamities

The sky is the limit for loss!
Gambling with failure
The escalation of damage...

- Speed loss,
- Quality loss,
- Minor stops,
- Yield loss

More expensive to fix
Breakdown

Partial Failure

Breakdown
Production stops

Total Failure

Breakdown!
Production stops

Total Failure
with local collateral damage

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Total Failure
with catastrophic damage

Basically a failure of due diligence. Lack of proper regard for risk management, ignoring the advice of experts and penny pinching
Gambling with failure
The escalation of damage...

Speed loss, quality loss, minor stops, yield loss

Breakdown
Production stops

Total Failure

Partial Failure

The sky is the limit for loss!

Total Failure with catastrophic damage

Basically a failure of due diligence. Lack of proper regard for risk management, ignoring the advice of experts and penny pinching

Depressingly common – Just recall the many petrochemical plant and railway disasters
Proactive maintenance

- The proper job of maintenance is not repairing failures but preventing failures
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- Management emphasis must be on equipment uptime and capability improvement – not side-tracked onto maintenance cost reduction.
Proactive maintenance

- The proper job of maintenance is not repairing failures but preventing failures
- Management emphasis must be on equipment uptime and capability improvement – not side-tracked onto maintenance cost reduction
- This requires a switch from reactive fire-fighting to engineering-led analytical thinking and proactive leadership
Proactive maintenance

- Your job is to prevent disruptive failure - that’s where your time and focus must be
Proactive maintenance

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Hmm, that’s what I’m really paid to do
Proactive maintenance

- Your job is to prevent disruptive failure - that’s where your time and focus must be.
- You should strive to maximise the amount of maintenance you do before failure.
Proactive maintenance

- Your job is to prevent disruptive failure - that’s where your time and focus must be.
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Proactive maintenance

- In the process, maintenance costs reduce dramatically by half, or more, for some.
**Proactive maintenance**

- In the process, maintenance costs reduce dramatically *by half, or more, for some*
- *First* the reliability improvement

In the process, maintenance costs reduce dramatically by half, or more, for some. *First* the reliability improvement.
Proactive maintenance

- In the process, maintenance costs reduce dramatically *by half, or more, for some*

- *First* the reliability improvement

- *Then* the maintenance cost saving
Proactive maintenance

- In the process, maintenance costs reduce dramatically - and automatically by half, or more, for some.
- First the reliability improvement
- Then the maintenance cost saving

Please don’t try to put the cart before the horse!
Proactive maintenance

- In the process, maintenance costs reduce dramatically *by half, or more, for some*

- *First* the reliability improvement

- *Then* the maintenance cost saving

...that’s just common horse sense!
Proactive maintenance

- In the process, maintenance costs reduce dramatically - and automatically by half, or more, for some

- First the reliability improvement

- Then the maintenance cost saving

- Do avoid shooting yourself in the foot!
Availability $\propto$ Reliability $\times$ Maintainability

With acknowledgement to Richard C Lamb – ‘Availability Engineering & Management for Manufacturing Plant Performance’
Uptime - Downtime state diagram

Availability \(\propto\) Reliability \(\times\) Maintainability

Plant Design, Operation and Maintenance

These influences of ‘state’ are assured by TPM

later…
Uptime - Downtime state diagram

Is King!

Availability = Reliability × Maintainability

Operating state

Down state

Plant Design, Operation and Maintenance

Maintainability
Uptime - Downtime state diagram

Availability \propto \text{Reliability} \times \text{Maintainability}

These are the prime indicators of performance

- Operating state
- Down state

Plant Design, Operation and Maintenance

\text{MTBF} \hspace{1cm} \text{MTTR}

Mean Time Between Failure

Mean Time To Repair
Uptime - Downtime state diagram

Availability $\propto$ Reliability $\times$ Maintainability

This is the Royal measure!

Plant Design, Operation and Maintenance

MTBF

MTTR
Uptime - Downtime state diagram

Measure and track MTBF for individual machines, cells, lines and whole sites

Maximise

Minimise

This is the Royal measure!

Availability

Reliability

Maintainability

Operating state

Down state

Plant Design, Operation and Maintenance

MTBF

MTTR

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Take the lead!

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- You need to apply the Total Productive Maintenance framework to achieve optimal manufacturing performance.
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- It’s you that must take the lead in the move from reactive to proactive maintenance.

- You need to apply the Total Productive Maintenance framework to achieve optimal manufacturing performance.

But, expect to be lonely and sniped at! Your credibility is on the line and proper support is likely to be scarce - until you show them what success looks like.
Total Productive Maintenance
The precondition of Lean manufacturing
TPM - pursuing perfection to cut waste

TPM seeks to add value by systematically reducing all types of loss to zero. The aim is NO accidents, NO breakdowns and NO defects.
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- TPM’s zero-orientation is totally in line with the 7 Wastes elimination of Lean – the pursuit of perfection.
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- TPM is not just in line with lean; it’s a precondition of lean. TPM is essential for Lean manufacturing to flourish.
TPM - the basic ‘5 pillars’

1. ELIMINATE 6 BIG LOSSES
2. AUTONOMOUS MAINTENANCE
3. PREVENTIVE MAINTENANCE
4. SKILLS ENHANCEMENT
5. ‘EARLY’ MANAGEMENT

TOTAL PRODUCTIVE MAINTENANCE

See the book ‘Introduction to TPM’ by Seiichi Nakajima
TPM - the basic ‘5 pillars’

TOTAL PRODUCTIVE MAINTENANCE

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These are the prerequisites of performance.
TPM - the basic ‘5 pillars’

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Do these properly...

These are the prerequisites of performance
TPM - the basic ‘5 pillars’

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5. ‘EARLY’ MANAGEMENT

Get this outcome…

TOTAL PRODUCTIVE MAINTENANCE
TPM - the basic ‘5 pillars’

Operator or user maintenance!
It’s great - but does depend on getting the co-operation of Management and others. If that’s not immediately forthcoming…

1. Eliminate 6 Big Losses
2. Autonomous Maintenance
3. Preventive Maintenance
4. Skills Enhancement
5. ‘Early’ Management
TPM - the basic ‘5 pillars’

1. ELIMINATE 6 BIG LOSSES
2. AUTONOMOUS MAINTENANCE
3. PREVENTIVE MAINTENANCE
4. SKILLS ENHANCEMENT
5. ‘EARLY’ MANAGEMENT

Concentrate on these – you can control them
TPM - the basic ‘5 pillars’

Planning!
Planned preventive maintenance
PLUS early detection and planned prioritised repair of defects. 90% of work activity should be ‘planned’
TPM - the basic ‘5 pillars’

Training!
Increases overall equipment availability by countering the ‘common cause’ failure of human error. >3% of available manhours should be allocated. Note, 80% of the maintenance workload is usually due to human acts and omissions. Training is not simply about giving information, its about changing attitude and behaviour.
TPM - the basic ‘5 pillars’

TOTAL PRODUCTIVE MAINTENANCE

Engineering!

It’s design configuration that determines equipment’s intrinsic capability, reliability and maintainability. While initial design is crucial, operational needs change and the equipment must respond - so **allocate 5% of manhours to engineering modifications**. And, roll over your engineering analyses of equipment into failure countermeasures – your PPM tasks.
Caution!

Engineering and management science is indispensable – but never lose sight of your equipment’s basic care needs.
The basic care precondition

*No asset abuse!*
The basic care precondition

No asset abuse!

BASIC CARE

1. CLEANED
2. TIGHTENED
3. LUBRICATED
4. ALL DEFECTS REPORTED EARLY
The basic care precondition

No asset abuse!

The prerequisites of successful maintenance and manufacturing performance. You’re going nowhere nice until these 4 conditions are substantially met.
The basic care precondition

No asset abuse!

1. CLEANED
2. TIGHTENED
3. LUBRICATED
4. ALL DEFECTS REPORTED EARLY

- Cleaned
- Tightened
- Lubed
- No unreported defects
Getting to grips

- A fundamental principle of Lean is to make the problems visible. *Drain the swamp!*
Getting to grips

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- However, when you're up to your backside in alligators – *constantly arising urgent issues* - it's easy to get diverted away from your best intentions for continuous improvement.
Getting to grips

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Fundamentally, the problem is one of *information overload*. You just can’t assimilate and process new information fast enough to get ahead. And yet you’re continually pressured to take instantaneous, well-considered decisions. Unfortunately, when developing events get ahead of your ‘thinking’, you just slide further into chaos…
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However, when you're up to your backside in alligators – **constantly arising urgent issues** - it's easy to get diverted away from your best intentions for continuous improvement.

**There’s a general need to become better organised.**
Getting to grips

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- However, when you're up to your backside in alligators – *constantly arising urgent issues* - it's easy to get diverted away from your best intentions for continuous improvement.

- If you set up the means to drain the swamp – a *performance management system* – you can engage your crew in the program, cull the alligators, gain control and make your life a whole lot easier!
Performance management

- The facilitating framework of a performance management system provides the means to achieve your goals and objectives - enabling you to assure and drive performance
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- Definitive action can be taken in the light of either adverse and positive trends – enabling both control and continuous improvement
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- Performance indicators promote visibility and alertness, together with organisation-wide common purpose and agility – everyone sings from the same hymn sheet
Performance management

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*You’ll need to do this if you’re thinking of implementing PAS 55*
Performance indicators

There are two categories of performance indicators

(measures or metrics)
Performance indicators

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(measures or metrics)

1. **Lagging indicators** – historical, quantified statements of fact. They measure results. Generally, they respond slowly to changes in the workplace.
Performance indicators

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1. **Lagging indicators** – historical, quantified statements of fact. They measure results. Generally, they respond slowly to changes in the workplace

2. **Leading indicators** – predictive of a desired future state. They measure inputs. They have a much faster response to changes in the workplace
Performance indicators

There are two categories of performance indicators (measures or metrics)

1. Lagging indicators

2. Leading indicators

Understanding the nature of the two types of indicators – their limitations and advantages - is crucial to the realisation of effective maintenance management.
Performance indicators

There are two categories of performance indicators
(measures or metrics)

1. Lagging indicators

There tends to be a somewhat fruitless pre-occupation with lagging indicators. While they quantify business-related goals, for example OEE, they are in fact useless for controlling the day-to-day, real-time activities of maintenance…

2. Leading indicators
Lagging indicators

- Lagging indicators are *backward-looking*. They report historical performance – not today’s
Lagging indicators

- Lagging indicators are **backward-looking**. They report historical performance – not today’s.

- They inform you of the state you’ve arrived at - they ‘score’ how you’ve done. OEE is 40%, Availability is 55% - and so on. And they tell you if you’re getting better or worse.
Lagging indicators

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Lagging indicators

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- They inform you of the state you’ve arrived at - they ‘score’ how you’ve done. OEE is 40%, Availability is 55% - and so on. And they tell you if you’re getting better or worse.
- But lagging indicators **provide no clue about the underlying causes of a problem** – or a success.
- Resulting actions are **corrective** and **reactive** – largely based on blind guesswork! *Euphemistically known as intuition…*
Leading indicators

For *visibility* and *proactive control*, you need *leading indicators*
Leading indicators

For **visibility** and **proactive control**, you need **leading indicators**

- Every lagging indicator has an associated set of driving influences - each influence is measured by a leading indicator quantifying its specific performance achievement
Leading indicators

For *visibility* and *proactive control*, you need *leading indicators*

- Every lagging indicator has an associated set of driving influences - each influence is measured by a leading indicator quantifying its specific performance achievement.

- The relationship between the leading and lagging indicators is one of *cause-and-effect*.
Leading indicators

For *visibility* and *proactive control*, you need *leading indicators*

- Every lagging indicator has an associated set of driving influences - each influence is measured by a leading indicator quantifying its specific performance achievement.

- The relationship between the leading and lagging indicators is one of *cause-and-effect*.

- The highest impact, *critical few* leading indicators should be chosen for each lagging indicator – discarding the *trivial many*. 
Leading indicators

- Leading indicators are used to identify *trends* – they’re NOT pass-fail monitors
Leading indicators

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Leading indicators

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- The time delay provides space to reflect on progress, adjust emphasis and take definitive action. Resulting actions are therefore **preventive** or **improvement**
Leading indicators

- Leading indicators are used to identify *trends* – they’re NOT pass-fail monitors.
- Lagging indicators inexorably follow the trend of their associated leading indicators - but with some *time delay*.
- The time delay provides space to reflect on progress, adjust emphasis and take definitive action. Resulting actions are therefore *preventive* or *improvement*.
- Without leading indicators, you can’t prevent failure or properly action improvements – you’ll just be *thrashing around in the dark*. 
Leading indicators

- Each leading indicator is associated with a best practice
Leading indicators

- Each leading indicator is associated with a best practice
- Best practices are identified and selected using benchmarking – you target the best available sources – BSI, SMRP, etc
Leading indicators

- Each leading indicator is associated with a *best practice*

- Best practices are identified and selected using *benchmarking* – you target the best available sources – BSI, SMRP, etc

- Your management focus must be on the *practices* - and on the *behaviours* of employees. These are the real determinants of success. Indicators only keep the score
Leading indicators

- Each leading indicator is associated with a **best practice**
- Best practices are identified and selected using **benchmarking** – you target the best available sources – BSI, SMRP, etc
- Your management focus must be on the **practices** - and on the **behaviours** of employees. These are the real determinants of success. Indicators only keep the score

In essence, the current ‘reading’ of a leading indicator is a measure of the present success of the application of its associated best practice
Leading indicators

- Each leading indicator is associated with a best practice
- Best practices are identified and selected using benchmarking – you target the best available sources – BSI, SMRP, etc
- Your management focus must be on the practices - and on the behaviours of employees. These are the real determinants of success. Indicators only keep the score
- You may gain, but can never sustain, competitive business performance without achieving the prerequisite level of competency in each contributory best practice – embedded competency
Your Dashboard of indicators

- Multiple indicators are essential to monitor the health of a ‘system’ and warn of a particular developing condition before it becomes a problem.
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- The interrelated leading indicators are monitored in aggregate – like the set of instruments on a car’s dashboard.
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Those with a late model AC Cobra will recognise this one…
Your Dashboard of indicators

- Multiple indicators are essential to monitor the health of a ‘system’ and warn of a particular developing condition before it becomes a problem.

- The interrelated leading indicators are monitored in aggregate – like the set of instruments on a car’s dashboard.

- Each indicator provides information on a specific and crucial aspect of a system’s health and performance – to safeguard the system so it can complete its mission successfully.
Your Dashboard of indicators

- Multiple indicators are essential to monitor the health of a ‘system’ and warn of a particular developing condition before it becomes a problem.
- The interrelated leading indicators are monitored in aggregate, like the set of instruments on a car’s dashboard,
- Each indicator provides information on a specific and crucial aspect of a system’s health and performance – to safeguard the system so it can complete its mission successfully.

Nevertheless, some individuals still run out of fuel and even blow up their engines! Success is not assured without prerequisite attentive and disciplined behaviour. Good practices and diligent behaviour remain paramount.
Relating all this to the maintenance management process
Maintenance performance management

- A process is a sequence of activities transforming inputs into outputs – a needed result…
Maintenance performance management

A *process* is a sequence of activities transforming inputs into outputs – a *needed result*…
Maintenance performance management

The inputs and outputs of the Maintenance Management process are well documented and undisputed...
Maintenance performance management

INPUTS

transformation

OUTPUTS

Maintenance Management

Plant Availability
Process capability
Regulatory compliance
(at lowest cost)
Maintenance performance management

A lagging indicator of performance measures and reports a process output – it’s a results measure

INPUTS

OUTPUTS

Maintenance Management

Plant Availability
Process capability
Regulatory compliance (at lowest cost)
Maintenance performance management

- **INPUTS**
  - A *lagging* indicator of performance measures and reports a process output – it’s a *results measure*
  - OEE, MTBF, MTTR, Accident Frequency, etc

- **OUTPUTS**
  - Maintenance Management
  - Plant Availability
  - Process capability
  - Regulatory compliance *(at lowest cost)*
But it presents you with a big dilemma - *How to act?*

**INPUTS**

- Act
- What?
- How?
- Where?

**OUTPUTS**

- Maintenance Management
- Plant Availability
- Process capability
- Regulatory compliance *(at lowest cost)*
Because of the many influences on output achievement, the lagging indicator won’t tell you what corrective action is needed to control or improve the result.
Maintenance performance management

INPUTS

That’s dangerous!
Events are outside of your control – so calamities can occur

OUTPUTS

Maintenance Management

Plant Availability
Process capability
Regulatory compliance
(at lowest cost)
Maintenance performance management

INPUTS

Maintenance Management

OUTPUTS

Calamity
This is the reason why the Authorities impose Health, Safety and Environmental Regulations to make organisations think and plan more about what they’re doing.
The previous absence of a serious event cannot be taken as an indication and vindication that everything is well under control.
No matter what it is, when a credible event is totally unacceptable, senior management must ensure effective **preventive controls** are devised, put in place and are working.
Maintenance performance management

A leading indicator of performance measures a specific process input and provides a trigger for definitive action…
Maintenance performance management

INPUTS

Maintenance Management

OUTPUTS

...enabling preventive, feedforward control of the needed output
Maintenance performance management

INPUTS

OUTPUTS

Maintenance Management

Act

it gives you time to assess the situation and take preventive action to avoid an indicated developing problem
Leading indicators are task-specific - so you need many of them!
Maintenance performance management

But strive to keep the number down to the *critical few*

5 to 10 measures

INPUTS

OUTPUTS

Maintenance Management

Act

Act

Act

Act

Act

Act

Act
You are the *controlling mind*. Choice of your indicator set - your *Dashboard* - is critical. It must balance process complexity against your *finite mental capacity* to assess, plan and coordinate activities.
Aligning business goals and performance indicators
Aligning performance with business goals

The *Performance Pyramid* model for integrated performance management was first proposed by Wang Laboratories in the late 1980s.

With acknowledgement to Wang Laboratories.
Aligning performance with business goals

- The *Performance Pyramid* model for integrated performance management was first proposed by Wang Laboratories in the late 1980s.

- The **business objectives** – as defined in the Boardroom – are deployed down and across the organisation. Targets are derived & set for factors in each activity contributing to success.

  With acknowledgement to Wang Laboratories.
Aligning performance with business goals

Goals are cascaded down to the operational level

OEE>85%

With acknowledgement to Wang Laboratories
Aligning performance with business goals

- **Performance indicators** are the means of assuring operational alignment with business objectives. They’re reported up and across the organisation.

With acknowledgement to Wang Laboratories
Aligning performance with business goals

- **Performance indicators** are the means of assuring operational alignment with business objectives. They’re reported up and across the organisation.

- **Quality, Delivery, Cycle Time and Cost** are the performance characteristics of ALL operational activities…

*With acknowledgement to Wang Laboratories*
Aligning performance with business goals

In business, performance indicators can be quantified for every operational activity, including maintenance, in terms of these 4 basic characteristics.
Aligning performance with business goals

Enterprise goals

Operations

- Quality
- Delivery (Quantity & Timeliness)
- Cycle Time (Process)
- Cost (Waste)

For example, First Time Through, Takt Time, On Time In Full Delivery, Injury Frequency, Production Rate, OEE, MTBF, Unit Cost…
Aligning performance with business goals

If you can’t put a number on it, you can’t measure it – and, if you can’t measure it, you can’t manage it. Trite but true!
Aligning performance with business goals

Enterprise goals

- Quality
- Delivery (Quantity & Timeliness)
- Cycle Time (Process)
- Cost (Waste)

Operations

The performance indicators monitor the most important determinants of success and provide the **stimulus for action**
Aligning performance with business goals

Enterprise goals

- Quality
- Delivery (Quantity & Timeliness)
- Cycle Time (Process)
- Cost (Waste)

Operations

The purpose of measurement is to gain information on which to act – if no action, you're wasting your time and just throwing good money away after bad.
In manufacturing and other equipment-intensive industries, maintenance provides the prerequisite *magic ingredient*, assuring successful business performance.
Aligning performance with business goals

Enterprise goals

- Quality
- Delivery (Quantity & Timeliness)
- Cycle Time (Process)
- Cost (Waste)

Operations

- Availability
- Capability (Process)
- Compliance
- Cost (Lowest)

Maintenance

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Aligning performance with business goals

Quality

Delivery (Quantity & Timeliness)

Cycle Time (Process)

Cost (Waste)

Enterprise goals

Operations

Maintenance delivers these essential conditions - the prerequisites of manufacturing competitiveness and success
Leading indicators of maintenance performance
There are many influences on maintenance performance
Leading indicators of maintenance performance

- Risk analysis BSI T18
- Planning BSI T19
- Operator maintenance BSI O4
- Planned & scheduled work BSI O5*
- Continuous improvement BSI O8
- Multiskilled BSI O15
- Corrective maintenance BSI O16
- Emergency maintenance BSI O17
- Preventive maintenance BSI O18*
- Condition-based maintenance BSI O19
- Schedule compliance BSI O22*
- Training BSI O23
- Response time
- Backlog
- Manpower utilisation
- Rework

British Standard
BS EN 15341
Maintenance Key
Performance Indicators

...more
Leading indicators of maintenance performance

Cost (Lowest)
Compliance
Capability (Process)
Availability

These are ‘big hitter’ indicators applying to MTBF, MTTR - and hence OEE

- Risk analysis BSI T18
- Planning BSI T19
- Operator maintenance BSI O4
- Planned & scheduled work BSI O5*
- Continuous improvement BSI O8
- Multiskilled BSI O15
- Corrective maintenance BSI O16
- Emergency maintenance BSI O17
- Preventive maintenance BSI O18*
- Condition-based maintenance BSI O19
- Schedule compliance BSI O22*
- Training BSI O23
- Response time
- Backlog
- Manpower utilisation
- Rework

...more
Leading indicators of maintenance performance

For leading indicators, the questions to ask are: which factors (influencers, drivers) push the system to a new desired state? Which factors are worth monitoring?

- Risk analysis BSI T18
- Planning BSI T19
- Operator maintenance BSI O4
- Planned & scheduled work BSI O5*
- Continuous improvement BSI O8
- Multiskilled BSI O15
- Corrective maintenance BSI O16
- Emergency maintenance BSI O17
- Backlog
- Manpower utilisation
- Rework

...more
Because the greatest potential for control exists at the point of action, ‘self control’ by the individual on the spot tends is ultimately the most effective control. The best leading indicators are therefore those which aid self control. This is the reason why all individuals involved in a process must clearly understand why their contribution is important and how it contributes to success.
Leading indicators of maintenance performance

Cost (Lowest)

Availability

Capability (Process)

Compliance

AND

Risk analysis BSI T18
Planning BSI T19
Operator maintenance BSI O4
Planned & scheduled work BSI O5*
Continuous improvement BSI O8
Multiskilled BSI O15
Corrective maintenance BSI O16
Emergency maintenance BSI O17
Preventive maintenance BSI O18*
Performance BSI O19
Maturity BSI O20
Service BSI O21
SI O22*
Response time
Backlog
Manpower utilisation
Rework

Most of these and others are defined in the 2007 British Standard

British Standard
BS EN 15341
Maintenance Key Performance Indicators

...more
Leading indicators of maintenance performance

- Risk analysis BSI T18
- Planning BSI T19
- Operator maintenance BSI O4
- Planned & scheduled work BSI O5*
- Continuous improvement BSI O8
- Multiskilled BSI O15
- Corrective maintenance BSI O16
- Emergency maintenance BSI O17
- Preventive maintenance BSI O18*
- Condition-based maintenance BSI O19
- Schedule compliance BSI O22*
- Training BSI O23
- Response time
- Backlog
- Manpower utilisation
- Rework

In addition, you can refer to the Whitepaper section of the Shire Systems website
Leading indicators of maintenance performance

Risk analysis BSI T18
Planning BSI T19
Operator maintenance BSI O4
Planned & scheduled work BSI O5*
Continuous improvement BSI O8
Multiskilled BSI O15
Corrective maintenance BSI O16
Emergency maintenance BSI O17
Training BSI O23
Response time
Backlog
Manpower utilisation
Rework
MTBF
MTTR
Use of a CMMS is also a stated BSI leading indicator of maintenance performance

British Standard
BS EN 15341
Maintenance Key
Performance Indicators

...more

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Leading indicators of maintenance performance

- Risk analysis BSI T18
- Planning BSI T19
- Operator maintenance BSI O4
- Continuous improvement BSI O8
- Multiskilled BSI O15
- Corrective maintenance BSI O16
- Emergency maintenance BSI O17
- Preventive maintenance BSI O18
- Condition-based maintenance BSI O19
- Training ratio BSI O23
- Response time
- Backlog
- Manpower utilisation
- Rework

Planning is pre-eminent!

MTBF + MTTR

AND

MTBF

MTTR

Planned & scheduled work BSI O5

Schedule compliance BSI O22

…more
Leading indicators of maintenance performance

- Risk analysis BSI T18
- Planning BSI T19
- Operator maintenance BSI O4
- Planned & scheduled work BSI O5
- Continuous improvement BSI O8
- Multiskilled BSI O15
- Corrective maintenance BSI O16
- Emergency maintenance BSI O17
- Preventive maintenance BSI O18
- Condition-based maintenance BSI O19
- Schedule compliance BSI O22
- Training ratio BSI O23
- Response time
- Backlog
- Manpower utilisation
- Rework

Besides the huge cost savings, sticking to plan reduces turbulence, creates order, eases personnel tension and stabilises morale.

...more
Getting going
The two main aspects of performance

*For starters*, evaluate two main aspects of your maintenance performance

- First, improvements in equipment reliability, maintainability and capability to increase plant effectiveness and product quality
- Second, improvement in the efficiency of maintenance work itself. All work must be carried out using the best, most economical methods – and your technicians should maximise the amount of time they spend wielding tools for gain
Performance management questions

And ask yourself

What’s causing me and my organisation the most pain? List the ten biggest issues you are involved in and establish their underlying patterns

1. What am I doing right?
2. What do I need to improve?
3. What do I need to start doing?
4. What do I need to stop doing?
Select the Critical Few indicators

Choose a ‘handful’ of high-impact indicators to get going with, say 5 - for example

1. Planned & scheduled work
2. Preventive Maintenance
3. Schedule compliance
4. Response time
5. Rework rate
The contribution of information management systems – your CMMS...
The essential contribution of CMMS

- To get the information outputs needed for performance management, you must have the right data inputs. Common sense!
- Good data collection and analysis are key requirements for a successful system
- There’s a morass of data to slice, dice and process in order to obtain pertinent, usable performance information
- Accounting systems are not definitive enough to handle the detail required. The breakdown and tracking can only be done by the Work Order system within a CMMS
- A CMMS can also help you to enforce data discipline with user-prompts and mandatory fields
Lean is about the elimination of waste – so only collect and process the *minimum data* to satisfy your performance information needs.

That is, data for immediate needs and, IDEALLY, for the medium term - because *longer term needs will undoubtedly have current data collection requirements*
The essential contribution of CMMS

Business Objectives

Technical Management
Asset Technical & Economic Data

Codes, Standards & Regulations

Compliance & Performance Monitoring & Control information

Work Management
The management of maintenance is fundamentally about the *mitigation of business risk*.
The essential contribution of CMMS

Business Objectives

Technical Management
Asset Technical & Economic Data

Codes, Standards and Regulations

Compliance & Performance Monitoring & Control Information

Using a Work Order system with the workflow steps – Approve, Plan, Schedule and Launch

Work Management
The essential contribution of CMMS

Business Objectives

Technical Management
Asset Technical & Economic Data

Codes, Standards & Regulations

Compliance & Performance Monitoring & Control Information

CMMS

Work Management

Besides the workflow steps, Work Management is complex because it involves many diverse sub-processes…
The essential contribution of CMMS

Business Objectives

- Technical Management
  - Asset Technical & Economic Data

- Compliance & Performance Monitoring & Control Information

- Work Management
  - Defect Management
  - Labour Management
  - Materials Management
  - SHE Compliance
  - Service Management
  - Purchasing Management
  - Contract Management
  - Financial Management
  - Warranties, Waste, etc

more…
The essential contribution of CMMS

Business Objectives

Technical Management
Asset Technical & Economic Data

Risk

Codes, Standards & Regulations

Maintenance Strategy

This lies at the heart of maintenance - but is often completely overwhelmed by the many other distracting, but lesser, considerations

CMMS

Work Management

Defect Management

Labour Management

SHE Compliance

Materials Management

Service Management

Contract Management

Purchasing Management

Financial Management

Warranties, Waste, etc

more...
Data collection, slicing and dicing

Workload
Slice & dice – classifying your workload

Total Workload

Preventive Maintenance

Programmed Maintenance (cycle > 1 year)

Corrective Repairs (Emergency & Routine)

Service Requests (Non-Maintenance)

Grounds Care

Minor Modifications

Replacement of Obsolete Items

Rehabilitation & Modernisation

Additions & Major Alterations

It is essential that the total Workload is carefully divided into categories to facilitate its technical and economic control.

Pre-Inspection

Testing

Corrective

Repairs

Replacement of Obsolete Items

Minor Modifications

Grounds Care

Additions & Major Alterations

Preventive Maintenance

Programmed Maintenance (cycle > 1 year)

Corrective Repairs (Emergency & Routine)

Service Requests (Non-Maintenance)

It is essential that the total Workload is carefully divided into categories to facilitate its technical and economic control.
Slice & dice – classifying your workload

Additions & Major Alterations

Preventive Maintenance

Predictive Inspection & Testing

Programmed Maintenance (cycle > 1 year)

Corrective Repairs (Emergency & Routine)

Service Requests (Non-Maintenance)

Grounds Care

Minor Modifications

Replacement of Obsolete Items

Rehabilitation & Modernisation

According to your needs, there can be other Work Types

...more
Slice & dice – classifying your workload

- Preventive Maintenance
- Predictive Inspection & Testing
- Programmed Maintenance (cycle > 1 year)
- Corrective Repairs (Emergency & Routine)
- Service Requests (Non-Maintenance)
- Rehabilitation & Modernisation
- Replacement of Obsolete Items
- Minor Modifications
- Grounds Care
- Additions & Major Alterations
- It’s got to work for you!
You can add new Work Types at any time - but when there’s no existing data, your system will not be able to present you with associated historical trends. Hence, while focusing on immediate imperatives, it’s best to try to foresee and provide for your future information needs into the 2 to 3 year term.
Slice & dice – classifying your workload

- **Preventive Maintenance**
- **Predictive Inspection & Testing**
- **Programmed Maintenance (cycle > 1 year)**
- **Corrective Repairs (Emergency & Routine)**
- **Service Requests (Non-Maintenance)**
- **Grounds Care**
- **Minor Modifications**
- **Replacement of Obsolete Items**
- **Rehabilitation & Modernisation**
- **Additions & Major Alterations**

It’s easy to set up, track and control as many Work Types as you need in your CMMS.
Data collection, slicing and dicing

Materials
Total materials movements and inventories *(Stores Stock)* must be divided up to facilitate technical and economic control.
Control and optimisation of stores value (Working Capital) requires targets to be set and values monitored for stock holding with different ‘movement’ characteristics - fast moving (<< 1 year), slow moving (> 1 year), insurance and surplus materials.
Slice & dice – classifying materials

- Common spares
- Refurbishable spares
- Plant spares
- Plant consumables
- Surplus materials
- Maintenance consumables
- General supplies
- Lubricants
- Tools & Instruments
- Engineers supplies
- Project materials

It’s easy to set up, track and control multiple Material Types, movement categories and storage locations in your CMMS.
Slice & dice – classifying materials

- Common spares
- Refurbishable spares
- Plant spares
- Plant consumables
- Insurance spares
- Project materials
- Surplus materials
- General supplies
- Lubricants
- Tools & Instruments
- Engineers supplies

CMMS

It’s easy to set up, track and control multiple Material Types, movement categories and storage locations in your CMMS.

It’s got to work for you!
Data collection, slicing and dicing

Asset Indenture
Slice & dice - Asset Indenture Levels

**System hierarchy**  
*assembly*

**What?**

- Conglomerate
- Company
- Site
- Area
- Unit
- Sub-Unit
- System (Cell)
- Asset
- Assembly
- Sub-assembly
- Part
- Element

**Location hierarchy**  
*geographical*

**Where?**

… your ‘Assets Tree’

An element of a Part – of importance in failure reporting only

Where?

What?
Slice & dice - Asset Indenture Levels

...your ‘Assets Tree’

Location hierarchy

System hierarchy

The number of geographical and assembly Indenture Levels needed depends on the size of your organisation, its industrial sector, your own maintenance strategy - and your organisation’s maintenance maturity.

An element of a Part – of importance in failure reporting only. For instance, a gear tooth.
Slice & dice - Asset Indenture Levels

Location hierarchy (geographical)

- Conglomerate
- Company
- Site
- Area
- Unit
- Sub-Unit
- System (Cell)
- Asset
- Assembly
- Sub-assembly
- Part
- Element

System hierarchy (assembly)

It's easy to set up, track, control and consolidate as many Asset Indenture Levels as you like in your CMMS.

An element of a Part – of importance in failure reporting only.
Slice & dice - Asset Indenture Levels

- Conglomerate
  - Company
    - Site
      - Area
    - Unit
  - Sub-Unit
    - System (Cell)
      - Asset
      - Assembly
      - Sub-assembly
    - Part
      - Element

Location hierarchy:
- geographical

System hierarchy:
- assembly

It's easy to set up, track, control and consolidate as many Asset Indenture Levels as you like in your CMMS.

CMMS

It's got to work for you!

An element of a Part – of importance in failure reporting only.
Slice & dice - Asset Indenture Levels

Location hierarchy
- geographical

System hierarchy
- assembly

CMMS

These also link into the materials management component of your CMMS
- of importance in failure reporting only
Data collection, slicing and dicing

Failures and Faults
Slice & dice – Failures and Faults

Following a *Failure*, an asset has one or more *Faults* requiring action…
Slice & dice – Failures and Faults

Following a **Failure**, an asset has one or more **Faults** requiring action…

A Failure is an **event**

A Fault is a **state**

**FAULT**
Following a **Failure**, an asset has one or more **Faults** requiring action...

**Fault Area**
- e.g. Conveyor trips out on overload
- e.g. Motor gearbox

**Fault Mode**
- e.g. Bearing seized

**Fault Action**
- e.g. Renewed bearing, seals and oil

**Notes:**
- Logged as a Temporary Repair - helical wheel damaged and no spare available. On order, delivery 10 days max

---

### Slice & dice – Failures and Faults

<table>
<thead>
<tr>
<th>Fault</th>
<th>Area</th>
<th>Mode</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conveyor trips</td>
<td>out on overload</td>
<td>Bearing seized</td>
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<td></td>
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<td>Logged as a Temporary Repair - helical wheel damaged and no spare available. On order, delivery 10 days max</td>
</tr>
</tbody>
</table>
Slice & dice – Failures and Faults

Following a **Failure**, an asset has one or more **Faults** requiring action...

It’s easy to categorise, log and analyse all plant failures and actions in your CMMS.
Slice & dice – Failures and Faults

Following a **Failure**, an asset has one or more **Faults** requiring action...

Standard ‘libraries’ can be defined in the CMMS for all these - to provide a structured framework, add engineering ‘intelligence’ and speed up data capture and analysis.
Slice & dice – Failures and Faults

Following a **Failure**, an asset has one or more **Faults** requiring action…

Standard ‘libraries’ can be defined in the CMMS for all these - to provide a structured framework, add engineering ‘intelligence’ and speed up data capture and analysis.

It’s got to work for you!
Slice & dice – Failures and Faults

Following a **Failure**, an asset has one or more **Faults** requiring action…

Note: Failures (breakdowns) are lagging indicators of performance. They invariably have systemic root causes. Therefore, **focus on the leading performance indicators** driving the elimination of these disruptive events - obviously the same ones as for MTBF!
In summary

- Because of its direct impact on equipment capacity and capability - its transforming potential on product quality, safety and production costs, maintenance is a high leverage contributor to business competitiveness and profitability.

- Costs are important, but a prime emphasis on maintenance cost-cutting will not lead to sustainable business performance improvement.

- Investing in plant reliability and utilisation improvement carries with it the promise that, along with product quality, production capacity and safety, costs will automatically decrease as a result.
In summary

- The by-product of better planning and less repairs is lower maintenance expense. And there will be more production for no extra capital cost, as the hidden factory comes on stream.

- To survive the recession, being good just isn’t good enough – you’ll have to be excellent. To be excellent, you’ve got to drive increased performance using a slick performance management system – you need a well-configured CMMS.

- The Engineering Manager has to lead the way for all these things to happen.
This is the end of the Maintec 2009 presentation

*If you’re interested in more reflections on performance indicators, please read on...*
Why performance indicators are needed
Why we need performance indicators

- Corporate strategy and goals are usually too abstract – too woolly - to guide managers and others in their day-to-day decisions and actions

- Performance indicators, particularly leading indicators, make abstract strategy more understandable and relatable. The translation of corporate vision into clearly defined workplace practices and hard measures - deployment - enables individuals to understand their required contribution and take the local, on-the-spot action necessary to achieve corporate goals

- Fundamentally, performance measures are deployed to influence and change behaviours for the better on the factory floor and in office suites. They act to align attitudes and actions with organisational needs. Performance indicators get everyone signing for the same hymn sheet; they have a positive effect on individual behaviour; they foster advantageous peer-pressure
Why we need performance indicators

- The effective use of leading performance indicators takes the guesswork out of managing a complex process. Without the necessary understanding of underlying process dynamics that the leading indicator thought-process brings, the only alternative is to make assumptions and rely on luck. Rational, fact-based decision-making is a much better approach than thrashing around in the dark.

- Business process and procedural improvements have traditionally been implemented as a result of investigations triggered by customer complaints, accidents and other mishaps. Progress has been based on the highly-favoured reactive management model of: First the incident, then the corrective action - a ‘learning from failure’ approach. This approach flourishes in industry and has been recently updated with the new ‘Lessons Learned’ addition to project management practice!
Why we need performance indicators

- The traditional, backward-looking approach uses lagging indicators to monitor performance. The big concern is that these indicators DO NOT provide the requisite management information and insight to prevent future untoward events.

- It’s clearly evident that the previous absence of an untoward event is not necessarily an indication and vindication that all is honky dory and activities are under effective control – while there may well be historical patterns, **the future is always different from the past**

- The reactive approach is not acceptable where health and safety are concerned. **Prevention is key**. The Government has stepped in over the years with Regulations to make organisations think and plan more about what they’re doing. Often judged as onerous by some managements, the proactive, best practice approach sought by the authorities is – naively perhaps - not always applied to managing performance in other areas of the business.
Why we need performance indicators

- Legislation and regulatory requirements - *compliance* - define the organisation’s minimum acceptable performance

- These compliance basics are not negotiable by senior management. *Regulatory measures therefore provide you, the Engineering Manager, with the power base to leverage maintenance advantage and build on the established compliance practices to apply good sense and increase operational performance overall*
The characteristics of good performance indicators
Characteristics of good performance indicators

*To be effective, performance indicators should...*

1. Be timely, objective and unambiguous - easy to understand

2. Be accepted, owned and under the control of the maintenance team and other individuals able to directly influence performance on the day, on the hour

3. Provide immediate and reliable indications of the present level of performance against the predefined targets and any trend in improvement or deterioration – *operational maintenance is essentially a real-time activity needing real-time information feedback*
Characteristics of good performance indicators

4. Provide information that can clearly guide and drive appropriate action to improve performance.

5. Respond sensitively to the work and procedural changes made to influence it.

6. Be easy to measure and collect. It should be cost efficient in terms of the personal effort and equipment required to gather and process the data. *Ideally, data should be gathered in the normal course of maintenance task planning and execution - and processed in a CMMS.*
Performance indicator
implementation process
Performance indicator implementation process

- Start with situational analysis. Referencing corporate vision, mission and goals, list the ten biggest issues you are facing. Establish their underlying patterns – you will undoubtedly find common causal factors.

- Deduce and affirm the headline lagging performance indicators – the success factors on which the achievement of corporate goals depend – MTBF, MTTR, OEE, Accident Frequency…

- For each lagging indicator, identify the associated leading indicators and their **best practices**.

- The number of leading performance indicators that could be potentially useful is far too large for any organisation to contemplate using them all. Individuals would just be overwhelmed and the organisation could become grid-locked with information.

- It’s paramount that you home in on the most valuable indicators – the Vital Few - those presenting the greatest threat to business performance or opportunity for improvement.
Performance indicator implementation process

- Apply the Pareto Principle – the 80/20 rule. “In any population that contributes to a common effect, a relative few of the contributors – the vital few – account for the bulk of the effect”

- Performance indicators are tools to aid the fixing of real and present problems – for alleviating pain. If they do not generate the right questions, then they’re a waste of time. Collecting data which has no clear connection to daily events has no value. Obscure measures are not relatable and so they’re effectively useless. Home in on factors that measure pain directly and are most relatable to the workforce, so they ‘get it’

- Quantify the medium term goal for each indicator selected and set its long term and immediate short term targets

- On the improvement journey, your initial and intermediate goals must be realistic and relatable - so they excite interest and elicit continuing commitment
Performance indicator implementation process

- Strive to set goals that force your organisation to ‘stretch’ to exceed its past performance - but don’t stretch it to the limit! While the 100% perfection aim of Lean is an admirable ideal to pursue, it’s a practical impossibility - human fallibility and frailty are constraints in every endeavour. A zero-tolerance acceptance of sub-optimal conditions is fine, but zero-tolerance for human error can undermine morale by making goals appear unattainable.

- Aim for perfection and settle for excellence. When you aim for the adequate, the result is likely to be mediocrity. This is why the ‘zero-based’ thinking of TPM and Lean is so motivating and compelling.

- When a performance standard is achieved for an indicator, reset the target to a higher standard. The actionable leading performance indicators will change over time in accordance with your organisation’s maturity and increasing sophistication of its management processes, so you must review them periodically.
Performance indicator implementation process

- A performance measure should be deemphasised once the target performance level has been achieved - the organisation can then move on to realising its next goal and step-change initiative. Adjust necessary action plans and select the next threats and opportunities to be addressed in the continuous improvement process.

- A precondition of ‘moving on’ is that the changed behaviours bringing about success have become ingrained in the organisation. Without the new behaviours being embedded and fixed – a permanent cultural shift - the gains won’t be sustained.

- Publish a tracking chart of progress at least monthly - provide visibility to whole plant. Employees often downplay and even openly ridicule the significance of progress whilst actually taking quiet pride in their success.

- Performance management is an iterative process and the overall objectives must be kept under continual review.

- Continually re-engineer to add more value. You will never reach perfection but, for a manufacturer, the harsh reality is: ‘stop trying - start dying’
Performance improvement cycle

Continually assess, re-engineer and ACT to add more value…

BUSINESS PERFORMANCE PLAN

Identify performance elements
Identify Best Practice (Benchmark)
Set objectives
Set KPIs

MAINTENANCE PERFORMANCE PLAN

Kick off
Act
Assess
Re-engineer
Review KPIs
Reset KPIs
Particular considerations

- Lean information management
- Human error
- Benchmarking
Information management and Lean

- Lean principles apply not just to shopfloor activities but to information management
- Piling up large inventories of products is clearly poor practice and the same is true for information – especially when you’re piling up garbage in the mistaken belief that it’s valuable. You ignore garage-in-garbage-out counselling at your peril
- Make sure the failure and job history details you keep are accurate and useable - and fit for present and future purpose
- Ensure the information you historise can be sliced and diced, so it’s able to give up its inner secrets when you eventually get to query it
- Take care! The devil is in the detail, so make sure there’s sufficient granularity built into your basic data to answer all those future questions you will undoubtedly have at some point down the road
Human error and Lean

- Human error is a huge problem in maintenance – just as it is in all processes relying on the timely, appropriate and attentive input of a human being, especially the safety-critical activities.

- Human error of one sort or another is typically the cause of 80% of an organisation’s maintenance workload – let’s face it, that does add insult to injury as far as the business is concerned.

- Human error is also the root cause of ALL of engineering-related disasters.

- Nevertheless, in a Lean environment, people are not viewed as the problems, but as the problem-solvers. The no-blame culture does not mean that human error is condoned. Human fallibility is accepted as a fact of life and creative strategies are encouraged and applied to mitigate both its causes and effects.
Benchmarking and Lean

- Learning only from our own most current experience - disregarding the lessons of history and the experience of others – will result in a host of avoidable mistakes costing the organisation a great deal in terms of money and grief. It’s an heroic but stupid strategy. It will never make you a winner in the 21st century because **winners use benchmark best practices**

- Xerox, who ‘invented’ benchmarking, define it as: “the continuous process of measuring our products, services and business practices against the toughest competition and those companies recognised as industry leaders”

- The idea is to use and build on the ideas and experience of the best-of-the-best – you leverage their valuable, proven learning to improve your own performance. Now what could be more Lean than that?
Single points of advice

Taglines to keep in mind...
Taglines to keep in mind

- **Just get going.** Don’t let the pursuit of perfection overwhelm you and get in the way of becoming just a wee bit better today.

- **Recurring problems are systems problems.** Because systemic problems result in a multitude of common cause failures, it’s well worth tracking their root-causes to ground and dealing with them as a priority.

- **Focus on the critical few.** There’s a tendency to start a new program with too many performance indicators.

- **Maintain a sense of urgency.** Performance management will not work when there’s lethargy. Solve today’s problems today – there’ll be new ones tomorrow to add to them.

- **Plan what you do and do what you plan.** The planning process in itself creates a virtuous spiral of continuous improvement.
Taglines to keep in mind

- Repairing equipment well is more important than repairing equipment fast. Don’t shoot yourself in the foot by letting your present maintenance actions embed equipment defects that will cause future failures.

- SHE accidents precipitate substantial extra costs. Track the failures and eliminate their systemic root causes to save the cash penalties that sap your organisation.

- The devil is in the detail. Others say God is in the detail. You can’t solve problems in general, only in detail.

- Superficial goals lead to superficial results. Aim for the stars and you may hit the moon. Aim for the fence and you’ll only shoot yourself in the foot.

- If you’re not winning, you’re losing. Adopt and foster a ‘no-status quo’ mindset.
Taglines to keep in mind

- **Improvement is a people issue - it’s the people, stupid!**
  You can devise the best system in the world, but when it’s not supported and used by the workers on the ground, it’s not worth the paper it’s written on. Orchestrating a golden link between human behaviour and management systems is key.

- **Reject self-fulfilling prophesies.** Never accept the defeatism of the nay-sayers. You can do it! Yes you can. Aim high, expect success and throw off the wet blankets others try to cast.

- **You get what you expect.** The Leader’s expectations set the tone and determine the achievement. An individual takes his reference from his Leader. As the Leader’s attention and focus turns on an issue, so then do the eyes and minds of the Leader’s staff.

- **Measures are no substitute for leadership.** Performance indicators, like CMMS itself, are just another tool to aid the Leader…
Thank you