Benchmarking Maintenance & Asset Management for Performance Improvement

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ABSTRACT

The value which maintenance and asset management provides an organization can be difficult to measure. Benchmarking helps to assess this value and the best practices it discovers help to improve performance. Best practices are reviewed from a range of different industries and six are described which can be used to review cost-effectiveness.

Keywords: Benchmarking, Maintenance, Asset Management, Best Practice

1. INTRODUCTION

Have you fallen into the trap of trying to improve plant performance by simply throwing more money at maintenance? It doesn't work. A benchmarking study of maintenance activities at over 130 plants around the world has confirmed what many of us suspected: increased maintenance expenditure on labour, spares and contractors pushes up the direct costs but the cost of downtime doesn't go away. However, by implementing successful practices throughout your organization, plant performance will be increased and costs reduced. In our study, some of the plants with the lowest maintenance costs also had the lowest downtime figures.

Don't believe those people who say maintenance benchmarking is impossible because of the need to compare tangibles such as labour costs with intangibles such as plant downtime costs. The Stock Markets of the world benchmark hundreds of thousands of companies every day taking into account tangible and intangible factors.

Since 1991 we have been involved in a benchmarking exercise with several world-wide organizations which wanted to reduce their downtime. Some of the results were surprising such as very little correlation between cost and age of plant or cost and output quantity. However, even in well-managed FTSE100 organizations, the cost of poor maintenance practices can still be significant. How much are poor maintenance practices costing your organization? Benchmarking can help you answer that question.

Key Points Covered during the presentation will be:

- Why is benchmarking important
- How should it be done
- Pitfalls to avoid
- Link to performance improvement
- Lessons from different industries
- Six best practices

There is also an opportunity for delegates to participate in an instantaneous benchmarking exercise using information in the appendix.

2. BENCHMARKING REVIEW

Benchmarking came to prominence in the 1980s when Ran Xerox used it as a tool to radically improve the performance of the corporation. Put simply benchmarking is achieved by making a comparison of performance between one organization and another which is acknowledged as having superior performance. There are three different ways in which benchmarking can be performed.

Internal benchmarking is where all the comparisons are done in-house between different sites, operating units of business streams. Comparisons are straightforward since everyone should be reporting data in the same way but the opportunity for radical learning is limited since everyone basically follows the same rules and mindsets.

Competitive benchmarking would involve external comparisons in the same industry. Here there are greater opportunities for learning but the comparisons are more difficult and there may be confidentiality and regulatory issues. Competitive benchmarking is often adjudicated by an independent third party. For example, Solomon Associates in the Oil & Gas industry.

The third way in which benchmarking can be performed is functionally whereby each department in the company in question is compared against the best performing similar department in any industry. For instance you might compare your maintenance with an airline; your distribution with FedEx and your marketing with Coca-Cola.

The way in which benchmarking is performed will be dictated by the level of change which the organization wishes to make: functional benchmarking may yield the biggest potential changes but it also carries the greatest risk.

There are some common pitfalls which we must avoid when benchmarking. The prime requirement is to make objective like for like comparisons taking into account different equipment types and duties. There must be sufficient data points to make sensible conclusions. Revenue / capital splits in financial figures should be closely scrutinized and allowances made for taxation distortions between different countries. It is vitally important that several benchmark parameters are considered together. Benchmarking costs alone is very dangerous because the comparator company might be doing things on the cheap or avoiding some essential activities altogether.

A UK Maintenance Benchmarking process conducted by the government several years ago revealed that the top five maintenance issues were conflicts with production, speed of response, lack of staff, lack of spares and excessive costs.

An internal benchmarking study in a well-run soft drinks company revealed that profits could be doubled by everyone following what the top performing plants were doing!

Carrying out benchmarking is like playing tennis – the follow through is important. So having collected information and distilled out the best practices, the follow through activity is to provide

the tools which will help people improve. These could consist of best practice guides, distance learning resources and face to face training sessions.

3. LESSONS FROM DIFFERENT INDUSTRIES

By benchmarking across different industries we can establish a wide range of good practices.

The airlines have carried out extensive research into failure and established that there are six patterns of failure. One of the most common is infant mortality – which any one involved with commissioning new equipment will instantly recognize. When ever we carry out any maintenance task we are exposing ourselves to the possibility of infant mortality failures when we re-start the plant. This means that our maintenance tasks should be minimized and designed to cause least disturbance to equipment. Maximum use should be made of condition monitoring. The airlines also developed a very rigorous technique for deciding what maintenance will be most cost-effective in any given circumstances. It is called Reliability Centred Maintenance or RCM.

3.1 Lessons from Oil Refineries

Solomon Associates have benchmarked refineries since '70s. The lessons learned are generally applicable to all process industries. There are basically four different families of equipment – each requiring a different type of maintenance strategy:

Fixed plant and civil - making up 40% - 50% of maintenance cost
Rotating equipment – making up 15% - 20% of maintenance cost
Electrical distribution – making up 10% of maintenance cost
Instruments and controls – making up 15% of maintenance costs

Plant Factors Affecting Maintenance Costs include plant size, location (in world),
Age and characteristics, process type, equipment complexity and redundancy. Practices Affecting Maintenance Costs include having a Reliability programme, Engineering standards followed, provision of competent Support staff and fit for purpose Procedures.

3.2 Lessons from the Chemical Industry

If something can go wrong it will go wrong – often during a maintenance period. Chemical Industry Initiatives include Hazard and operability studies, hazard analysis, Classification of sites with major risks, Material safety data sheets (MSDS), Permit to work systems and Change control procedures. All of which are used extensively across many different industries.

3.3 Lessons from the Nuclear Industry

Tools from the Nuclear Industry include Failure modes and effects analysis, Quantified risk assessments, Fault trees and Reliability modeling using extensive databases.

3.4 Lessons from Utilities Industries

These include Management of extensive large-scale investment programmes, Management of mobile workforces, Justifying capital replacements on t he basis of asset condition and performance, Handling large volumes of data.

3.5 Lessons from Manufacturing

Lesson here include Supply chain management, Real time process simulation and modeling as a "What if?" tool, Lean & agile manufacturing techniques and Statistical Process Control.

4. SIX BEST PRACTICES FOR THE RECESSION

Here are the six best practices drawn from a wide range of different industries which might prove very useful during the curren.

4. 1 Review Maintenance

Agree with users what the equipment has to do and use this as the basis for the maintenance programme. Condition monitoring should be your tactic of choice provide it is technically feasible and cost-effective. Reserve time-based overhauls where there is predictable deterioration. Functional test for serious hidden failures. Re-design where serious failures cannot be predicted or prevented.

4.2 Predictive Maintenance Programme

This is inherently self-correcting whereas time-based is not. So for example if the rate of wear on a component were to increase, then a failure would occur before the next time-base replacement was due. However, condition monitoring would spot the deterioration before a failure occurred. Maximum use shoul d be made of pla nt process parameters such as flow rate, temperature, pressure as well as the human senses.

Predictive maintenance needs to be fully integrated with the rest of the maintenance programme and the results used to 'flex' other routines as required.

4.3 Performance Management

Long-term and short te rm control needs to be exercised. We need to consider the details of each maintenance task separately as w ell as w hether all of these tasks are m oving us further along towards our goals.

4.4 Plant Resilience

This answers the often posed questions: where are the biggest risk areas and where are we sailing close to the wind? The assets are broken down into process and utility systems. For each system, a multi-discipline team agrees all of the issues which prevent the system operating as required. These issues are then modeled to derive a business cost benefit case and an improvement plan is developed.

4.5 Spare Parts Inventory Review

The finance director will never let us have all of the spare parts we would like so there is a need to balance the downtime cost and risks against the cost of holding the spares in our inventory.

4.6 Stripping Out Cost Intelligently

Eliminating unnecessary maintenance. Minimizing required maintenance. Use variations between workgroups / assets, etc to establish baseline maintenance requirements. Copying successful practices wherever you find them. Employing random sampling for inspections rather than doing every one.

5. CONCLUSION

It is sometime difficult to assess the true value which maintenance and asset management brings to an organization. However, benchmarking can be a very effective way to assess this value.

Successful practices from several different industries which are generally applicable have been reviewed.

Six practices were selected which might prove very useful during the current recession for improving cost-effectiveness.

Finally, the table in the appendix provides an opportunity to do an instant benchmarking exercise.

6. BENCHMARKING APPENDIX

BENCHMARK	ALL SECTORS		
	AVERAGE	TOP25%	TOP10%
SPAN OF CONTROL	13- 29	>40	
MECHANICS/ EFFECTIVE PLANNER	42 - 70	>80	
OPERATORS/MECHANIC	15 - 27	20	>30
NUMBER OF CRAFTS	4 - 7	2	
PM ROUTINES BY OPERATORS	5% - 17%	>25%	
ABSENTEEISM	3.2% - 4.0%	2% - 2.4%	1% - 1.9%
TRAINING DAYS (NEW EMPLOYEES)	12 - 21 DAYS	20 - 30 DAYS	28 - 48 DAYS
TRAINING DAYS (EXISTING EMPLOYEES)	4 - 7 DAYS	5 - 8 DAYS	10 - 20 DAYS
OFF JOB TRAINING DAYS	2 -3 DAYS	3 - 4 DAYS	5 - 8 DAYS
SCHEDULE COMPLIANCE	25% - 53%	>70%	
ACTUAL WORKING TIME	36% - 47%	>52%	
OVERTIME	20%	10%	5%
WORK ORDER COMPLIANCE	69% - 89%	>95%	
PLANNED WORK	40%	60%	80%
WORK REQUEST COMPLIANCE	73% - 84%	>90%	
CAPACITY USED FOR CHANGES	8.5% - 10%	2% - 3%	<1%
OEE	48% - 70%	>70%	
COMPONENT SET UP TIME	84 -188 MINS	15 - 16 MINS	6 -10 MINS
AVAILABILITY	76% - 93%	90% - 95%	>95%
ASSEMBLY SET UP TIME	25 - 39 MINS	5 - 10 MINS	2 - 4 MINS
BREAKDOWN WORK	45%	20%	10%
CONRACTORS COSTS	11% - 30%	>40%	
OSHA INJURIES PER 200000HRS	4.3 - 2.5	<1	
STORES SERVICE LEVEL	94% - 98%	>99%	
MANUFACTURING STOCKTURNS	9 -13	11 - 18	18 - 30
MAINT. STORES/PLANT REPLACEMENT	1.1% - 0.5%	<0.3%	
MAINT STORES / TOTAL MATERIALS	44% - 75%	<19%	
STORES VALUE/MECHANIC	£7500		£5000
MAINTENANCE COST/OPERATING COST	20%	10%	4%
REPLACEMENT VALUE PER ENGINEER	£80M-£144M	>£160M	
MAINTENANCE COST/TURNOVER	4% - 8%	<3%	1%
% NEW PRODUCTS IN 5 YEARS	2% - 4%	7% - 15%	55% - 62%
MAINTENANCE/MECHANIC	£52000		£49000
REPLACEMENT VALUE PER MECHANIC	£2.6M - £4M	>£4.8M	
ADDED VALUE PER OPERATOR	£45K - £72K	£56K - £90K	£85K - £140K
MAINT COST/ PLANT REPLACEMENT	2.6% - 4%	2% - 2.5%	<2%
SUGGESTIONS PER MECHANIC	0.5 - 4.0	>4	
EX-STOCK AVAILABILITY	86% - 97%	98% - 99%	>99%
DELIVERY RELIABILITY	87% - 94%	98% - 99%	>99%
SCRAP RATE	2.7% - 5.8%	0.5% - 1.3%	<1%

REFERENCES

[1] DTI UK Government Benchmarking www.innovation.gov.uk

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