Investing in Reliability - Establishing Maintenance as a Profit Center

Rakesh Makhija

SKF Bearings India Ltd., Mumbai

INTRODUCTION

Historically, maintenance has been regarded as a necessary cost of doing business. Over recent years much has been written about "return on investment in maintenance" or suggestions that maintenance be regarded as a profit center. In the ideal state maintenance should engage in a strategic partnership with other functions of the enterprise, so as to identify and support the enterprise in which a reliability focused maintenance process can contribute to the achievement of predetermined business goals. An understanding of plant effectiveness issues (availability, performance, and quality) is a pre-requisite to the successful optimization of maintenance activities - a process that optimizes maintenance according to business results rather than merely on maintenance costs.

If comparisons are drawn between "maintenance" and "reliability" then it is first necessary to understand the meanings of these terms.

Maintenance comprises practices through which organizations seek to ensure that physical assets continue to fulfill their intended functions. This implies sustaining the status quo, ensuring that an item is able to deliver its inbuilt capacity (or inherent reliability). Maintenance is not about improving that performance irrespective of operational requirements.

Reliability focused practices, on the other hand, are used to determine the maintenance requirements of a physical asset in its operating context. This involves the analysis, monitoring and optimization of the asset to ensure that it meets the desired operating performance.

Thus, reliability focused maintenance is a process of continuous improvement that focuses on the operational requirements of the asset instead of a repair / maintain function.

There is increasing interest to establish maintenance as a profit center, and indeed some now speak of business-centered maintenance. If managed correctly, maintenance can be optimized to the point of providing a positive net return.

The impact of reliability

It is well known that most companies actually operate their plant at about 70% of the maximum potential. So where does the 30% loss disappear to? At high level these can be classified as:

- Availability losses caused by need to remove plant from service in order to undertake maintenance on either a planned or unplanned basis.
- Efficiency losses caused by need to run plant at reduced production speeds, perhaps in consequence of machine problems. Time lost through product changeovers with associated switch over / set up / run up time is also included.
- Quality losses caused by inability to produce first-grade product all of the time.

Organizations are invariably aware of the impact of maintenance upon plant availability. In general conversation "availability" is often used as a collective term covering all of these losses that may occur as a result of some inadequacy of machine operation. For clarity they are perhaps better summarized under the general term "effectiveness". Study of published benchmarks indicates that world class performance (effectiveness) is closer to 85-90%.

Further study of these benchmarks reveals a significant fact, in that the absolute best performing companies combined high reliability with lower maintenance costs.

This illustrates that improved reliability need not necessarily imply an increase in the cost of maintenance. Neither does it imply, however, that world-class performance can be achieved simply by tight control of maintenance costs. Many companies have learned an expensive lesson - that maintenance

Keynote Address During IPPTA Zonal Seminar on 4th & 5th July 2003, on Maintenance in Pulp and Paper Industries at Coimbatore.

delayed typically comes back multiplied in terms of cost and consequence.

Reliability-focused maintenance optimization involves the following subsets:

- Defining maintenance philosophy, policy and strategy.
- Planning maintenance and executing the optimal task set in its entirety and on time.
- Streamlining the maintenance data.
- Measuring results and acting upon them.

A properly conducted optimization provides an understanding of what maintenance tasks must be done, and why. It must also ensure that the plan is faithfully put into practice, with tasks undertaken in a complete and timely manner. It is also important that reporting / feedback mechanisms exist that allow comparison of actual results with expected out comes, and that any lessons are learned and fully utilized as the basis of future improvements to the plan.

Reliability - The dream and the reality

Very few organizations enjoy the fruits of a fully and properly defined maintenance strategy. For many companies maintenance is not so much a process as a collection of activities that has evolved over many years.

Typically, this includes some planned and perhaps predictive tasks that were instigated in reaction to some past incident. In practice, it is estimated that maintenance costs vary between 15% and 40% of manufacturing costs, and that as much as 50% of this activity may be unnecessary, which means between 7.5% and 20% of manufacturing costs are actually not justifiable.

Various studies on the subject reveal some interesting statistics:

- Between 20% to 70% of all maintenance is reactive in nature. Reactive maintenance is typically ten times more expensive than predictive maintenance.
- The direct cost of repairs undertaken on a breakdown basis is typically three times the cost of planned repairs.
- An emergency repair can effect three to five times more production stoppage, in comparison to a planned repair work.

Maintenance fails to be a strategic enabler for companies who continue to view maintenance as a repair focused "fire-fighting team" and a support center at best, and at worst - a necessary evil. Any company that sees maintenance as a fire prevention team and not as a strategic partner in achieving increased reliability and predictability in both operations and in output is missing a huge opportunity.

Planned Maintenance (PM) Issues

It is estimated that preventive activities account for between 25% and 50% of maintenance, at a cost equating to around five times that of predictive maintenance. Additionally, between 40%-60% of this preventive tasks may serve very little purpose. This could be due to the fact that too much is done too often or too little is done too late, making such activities ineffective and redundant.

Experience suggests that planned maintenance tasks are often not based on detailed understanding of plant failure modes. PM tasks developed in consequence of an incident on one machine are often duplicated for applications across all similar machines in the plant, irrespective of differing functions or criticality.

Very often the work instructions provided for these tasks are not sufficiently detailed and frequently lack critical information regarding parts / tools requirements, resulting in time loss through repeated trips to stores.

In consequence of these and other issues, PM tasks often assume a low priority in the eyes of the workforce, and the programmes gradually fall into disrepute.

Predictive Maintenance (PM) Issues

Predictive maintenance programmes are now commonplace, and the arguments in favour of their adoption are extensive and compelling. The cost comparisons used above for corrective and preventive maintenance are forceful arguments, so why does predictive maintenance compare so favourably with these other approaches? The returns on investment in such systems can arguably be categorized into short and long-term categories.

In the short term, predictive technologies should lead to a reduction in unplanned downtime, as they provide an early warning that allows the maintenance professionals to take timely corrective action that avoids the consequential damages of a break-down due to undetected fault, and better planning of spares thereby avoiding payment of premiums to spares or inventory cost. Product quality also improves as the consistency of machine performance improves.

However, the longer-term returns are potentially far more valuable. Such systems offer scope for significant reduction in scheduled downtime through substitution of time based replacement/ overhaul tasks with routine, non-intrusive and less time consuming monitoring activities. Spares' inventory is reduced since the early warning of parts requirements provided by the system affords a higher level of dependence on outside suppliers, and tolerance of somewhat longer times lead to supply.

All of these arguments appear logical and convincing; yet, in their 2001 census of manufacturers, Industry Week reported that just 37% of managers gave a high rating to preventive / predictive maintenance. Why then do so many PdM programmes fail to live up to their early promise? There are probably two principal reasons for this.

PdM programme management

Firstly, many PdM programmes are implemented in isolation of other maintenance planning and scheduling activities. All too often they lack a properly defined supporting infrastructure. This means that early warnings generated by the system are not always reacted to in a timely manner. Even more common is the lack of "follow through" activity. There is also frequently no "post-repair check".

Scale of the PdM programme

Secondly, PdM programmes frequently fail to develop in the way that they were intended to. Many PdM programmes kick off in a small way as "pilot programmes" to be expanded at some later date according to development of expertise, based on "start small and build" approach.

Experience suggests that the lack of a properly defined management infrastructure also means the condition monitoring checks are often carried out alongside existing PM activities rather than in place of them. This perceived need to maintain established preventive activity levels creates a resource barrier that limits the scope of the PdM programme.

Investing in reliability

Maintenance cannot function efficiently in isolation from the rest of the enterprise. Output from other sub-systems provides input to the maintenance sub-system. Similarly, the principal output from the maintenance subsystem is plant effectiveness in the form of plant availability, performance and quality. These linkages must be considered in any detailed assessment of the maintenance department. A significant change in the maintenance sub-system must impact plant effectiveness and hence the business results.

There is a need to quantify that impact in order to achieve a comprehensive understanding of the potential gains and to thereby build a financial justification that will support and sustain (or refute as appropriate) the proposed changes.

Failure to properly understand the business gains will mean that cost will be incurred in 'improving' maintenance based on nothing more than faith that it's the right thing to do. If the strategists are actually disconnected through a link to the business results that is weak, vague, unpredictable, or non-existent, then the optimization process will not be supported by a sound business case.

The elements of the reliability process

Establishing the financial rationale

Availability, performance and quality issues must be well understood from the outset, since it is these factors that primarily dictate the extra profit available through release of unexploited capacity. This additional revenue is a primary component of the maintenance cost optimization process.

Establishing the technical rationale

Truly understanding the business goals and effectiveness issues provides the "whys" for the programme. The "how's" are then derived from the detailed "Maintenance Strategy Review" (MSR), which is defined as "A systematic review of plant or equipment, evaluating the manner in which it fails within a given operational context, the consequences of failure and the identification of technically feasible and cost effective maintenance strategies to minimize the consequences and frequency of failure."

Sustaining the effort

The key to achieving this world-class performance is in engaging the entire organization in eliminating the defects in the system. The change to a reliability focus then truly is "cultural" in nature, and success requires a realization across the organization that reliability is everyone's concern and responsibility.

This is a time consuming effort and it requires keen attention to the organizational, motivational, and cultural factors within the organization. It becomes evident that there is no "quick fix" that allows realization of the potential of the hidden plant. Conventional wisdom suggests that it takes typically between two and four years.

Monitoring progress

Performance indicators that are used to track the progress of the transition must be tied to business gains as outlined earlier in this text. Attempting to monitor the optimization process simply from maintenance cost viewpoint can produce a distorted picture that casts doubt upon the validity of the programme.

CONCLUSION

It Building a successful financial and technical rationale for optimization of maintenance practices requires that two key issues be thoroughly addressed:

- A sound understanding must be gained of the asset and its inherent capabilities.
- A sound understanding of the business goals of the organization and of the impact of the asset upon those goals.

An attempt on maintenance optimization without satisfying these preconditions would suggest that the effort is reliant primarily on payback through cost reduction rather than working from a sound business platform.

The maintenance programme content that is properly arrived at and supported commercially and technically, executed within a true process is then a focused reliability based maintenance effort that when faithfully implemented (dynamic living process) and learnt from is highly likely to be an investment.

Reliability maintenance holds great promise in helping us reach world scale productivity levels.