

Effective Maintenance Strategy is Key to Success for Maintenance Optimization Programs

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As a result of free trade and global competition, industry in U.S. is facing increasingly difficult challenges. This is exhibited by reduced sales volume and margin of profit. In response, many companies have implemented accelerated cost cutting measures. At the same time maintenance is expected to guarantee plant reliability and improve plant utilization rates with economic efficiency. Many of the US industries, which adopted maintenance improvement philosophies, Reliability Centered Maintenance (RCM), Total Productive Maintenance (TPM), have been known to call off the program due to failure in achieving desired results. Several reasons for these program failures have been identified by researchers, some of these are:

- Organizational aspect of change (MOC) is neglected.
- Financial objective of implementation is neglected.
- Implementation framework not aligned with industry type - mission based (Military, Aircraft, Airforce, nuclear) and PPM (Power, Process and Manufacturing).
- Equipment failure database does not have enough useful data to perform RCFA, FMEA, etc.
- Lack of experience in implementation process.

Reliability improvement programs and predictive technology have a proven positive impact on the profitability of the company worldwide. Why these great programs are not the complete solution to maintenance challenges in PPM industry. The answer lies in the management of maintenance. Maintenance improvement approaches are focused on identifying gaps in the current operational, maintenance and warehouse policies by managing the risks of equipment failure. Without understanding the maintenance management process and establishing a sound maintenance strategy, no improvement effort will have an impact on profitability of the industry. "Maintenance management is important to all business sectors-and critical to those that are capital intensive." ¹ - John Dixon.

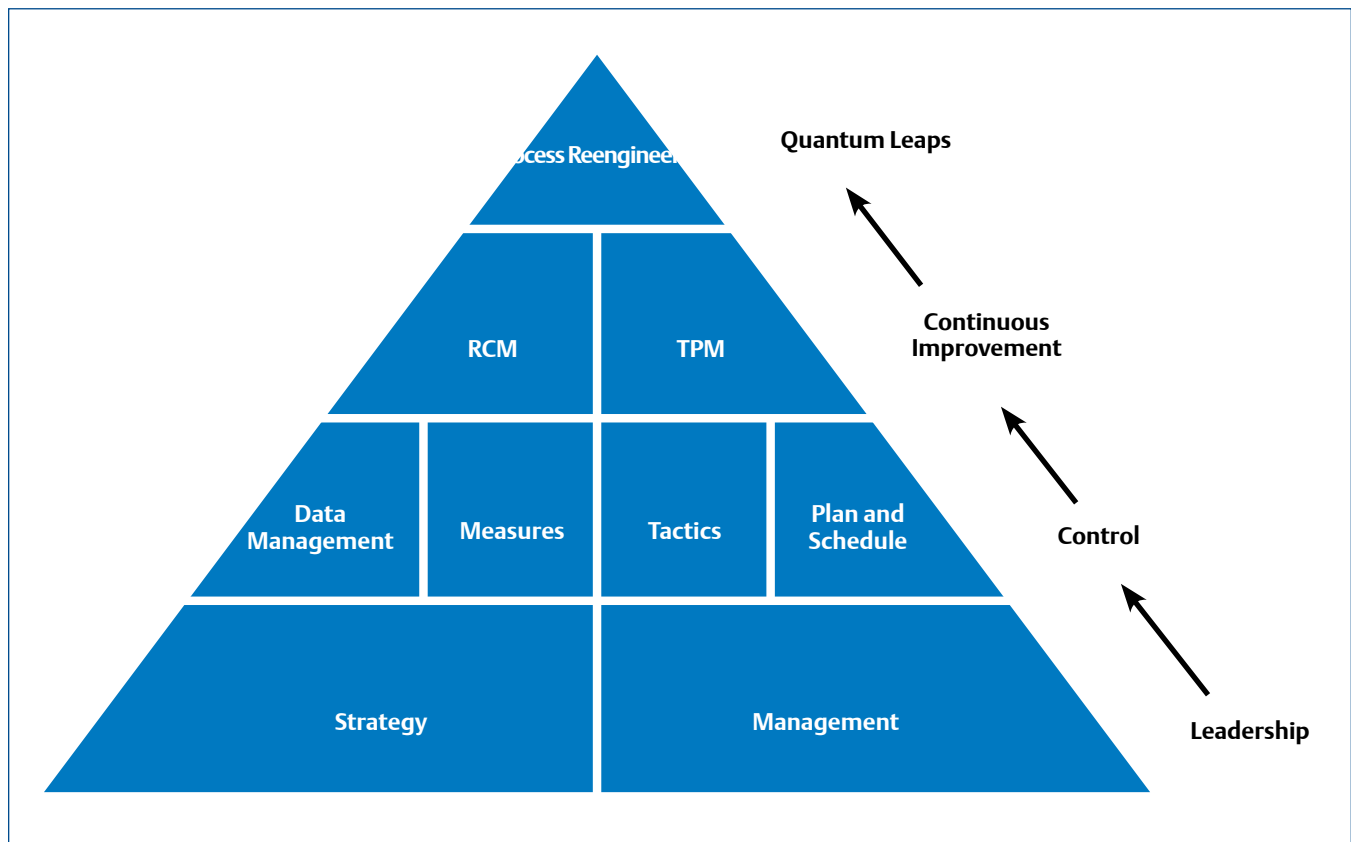


Figure 1 – “Uptime – a structured approach” by John Dixon¹.

Maintenance Management is a Business Process

Power, process and manufacturing (PPM) industry by nature is 'Failure Tolerant'. It means the driving force for maintenance decisions in these industries is 'Profit' not 'Reliability'. Industries need reliability programs to ensure profit in terms of better utilization of existing production resources.

This defines maintenance as a 'Business Process'. The U.S. Department of Commerce's Bureau of Economic Analysis (BEA) broadly defines 'Service Industries' as those providing products that cannot be stored and are consumed at the place and time of purchase. Thus, maintenance can be classified under 'Service Business' that involve only the performance of actions on behalf of the stock holders or owner and have no tangible outcome. Managing and controlling costs are crucial to any business. In the service industry, managing cost is complex because the product is not tangible. The Maintenance Service has impact on the profitability of the company in terms of reliability, quality, availability, capacity. Instead of marking maintenance services as the cost of maintaining equipment, it should be defined as the economic value an enterprise is able to extract from the profit in return for the higher availability, higher reliability and increased quality.

Fig. 2² shows that maintenance cost elements (inputs) have a valuable and immediate impact on profit. It forms an inseparable part with production output and industry profitability. Changing maintenance cost elements will change throughput and the other two relatively. Random elimination of "waste" (spares, people, PM intervals, etc) will tend to reduce the effect of maintenance process and hence lead to increased risk. A complete and thorough understanding of the modern maintenance process is an absolute requirement before the removal or reduction of any process element or input. If this understanding is not present, then loss of maintenance process control will result, regardless of whatever reliability tool or philosophy is in place.

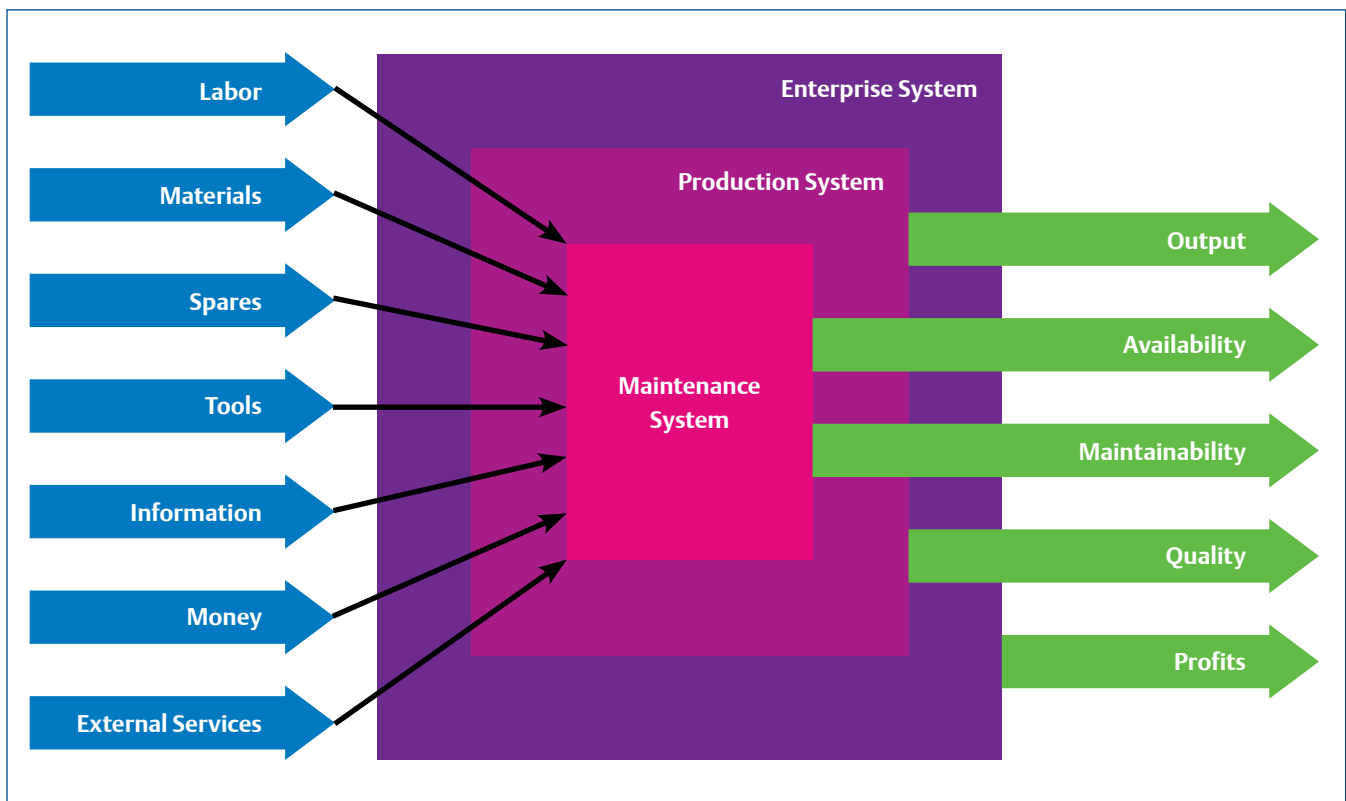


Figure 2 – Maintenance: Hub of internal and Enterprise-wide outputs².

Maintenance Strategy

There is no universal framework that satisfies maintenance needs in every industry. Traditional maintenance strategy is based on believe that maintenance is all about preserving the inherent reliability or built-in capability of any equipment. This framework leads to maintenance actions aimed at the prevention of breakdowns and failures. Focused on 'Fix it before it broke' theme, it leads maintenance, and industry as whole, towards expensive and less effective time based maintenance. Having no alignment with the long term business goals, maintenance becomes an expense and always management's target for cost cutting efforts to become competitive with other businesses. Smith defines maintenance strategy as 'making our inspection, servicing, and repair/replace actions as effective and useful as possible' ³. Considering the terms 'effective' and 'useful', an effective strategy includes processes and actions that must be developed and implemented to enable maintenance to focus its efforts on equipments that are highest priority for industry profitability. Covering all aspects of maintenance management, it ensures that resources and risks are managed effectively and that the maintenance of assets aligns with business objectives.

Foundation for Maintenance Strategy

There are two possible approaches that can be the foundation for maintenance strategy:

1. Equipment-Oriented (Traditional)

Traditional maintenance approach is based on two basic tasks – corrective actions and time based preventive actions. The concept behind this approach is that all equipments need time based overhauling to ensure safety and reliability. Cost cutting measures are focused on reducing maintenance cost elements (fig 2) in response to reduced sales volume or reduced profit.

2. Customer-Oriented

Customer-oriented maintenance management approach focuses on the needs of the client. A key benefit of this approach is that maintenance efforts, and thereby costs, are focused on achieving the results that increase customer satisfaction. Possible customers for maintenance service can be 'Production' or 'Shareholder/Owner'.

- a. If we consider production as customer for maintenance service, the process will be relatively static focusing resources on issue as maintenance schedules, unscheduled failure and survival rates. The essence of this approach is to find the optimal maintenance schedule for minimizing lost revenue or equipment downtime while maximizing the service life of the equipment. Some characteristics of this approach are;
 - i. The maintenance organization is more focused on planning, scheduling and spare parts arrangement.
 - ii. Plant availability and reliability is ensured by relying on time based maintenance.
 - iii. Maintenance culture values individualism instead of team work.
- b. If we consider 'Stock Holders' or 'Owners' as the customer, maintenance will be a dynamic process that add value to company profitability. As business condition changes over time, maintenance can also improve its planning process and target resources where they are most cost effective, achieving maximum benefit from each dollar. One distinctive feature of this approach is the ability of maintenance organization to discriminate effectively between the varying production patterns. To address maintenance needs, organizations rely on team approach to preserve function of equipment. Appropriate predictive and reliability techniques can be deployed in an integrated team oriented and proactive environment.

To turn maintenance into new profit opportunity for industrial competition, maintenance strategy should include following elements and characteristics.

Element of Maintenance Strategy

The purpose of breaking strategy into elements is to maximize the effectiveness of resource allocation and to systematically manage equipment based upon criticality, priority, and funding demands.

Maintenance Budget Strategy

This will determine the approach for funding maintenance needs for critical assets. The best maintenance strategy in the world is useless if not properly funded. Instead of increasing maintenance budget by some percentage of last year's expenditure, budget should be focused on three major parts:

- **Routine Maintenance Budget:** This includes direct cost of maintenance as salaries for all employees in maintenance, utilities, equipment, spare parts and repairs.
- **Preventive Maintenance Budget:** This includes costs to maintain existing preventive and predictive maintenance programs and also indirect cost of maintenance as loss-related costs.
- **Maintenance Optimization Budget:** Proactive maintenance is always the most cost-effective approach. To reduce the future increase in maintenance cost, budget should allocate funds for maintenance optimization, predictive maintenance and reliability improvement programs. Progress of 1-2% per year in setting improvement goals should be considered good.

Equipment Strategy

This will determine a systematic method for identifying the physical assets that must be maintained. A maintenance program should be decided to incorporate a quantitative prioritization procedure to determine criticality (in five areas; Safety, Environmental, Production, Maintenance & Quality) with equipment identification method (equipment hierarchy and tags) to facilitate the assignment of resources.

Management Strategy

This will establish management systems and work controls. It defines how work is to be done to ensure that maintenance is conducted in a consistent and efficient fashion. Documentation should be an integral part of a maintenance program and should address:

- Formal policies, procedures, goals and objectives, and roles and responsibilities.
- Work control system by which maintenance activities are identified, initiated, planned, approved, scheduled, coordinated, performed, and reviewed for adequacy and completeness.

Reliability Strategy

This will determine a proper balance of corrective, preventive and predictive maintenance to provide a high degree of confidence that equipment degradation is identified and corrected, equipment life is optimized, and the maintenance program is cost effective.

Training and Qualification Strategy

This will determine job specific training and qualification programs to ensure that Maintenance personnel are qualified to perform the tasks required of them. The training and qualification methods can include on-the-job training, classroom instruction, computer-based training or hire-in qualifications, etc.

Characteristics of Maintenance Strategy

In order to be effective and continue to contribute to the growth of asset management, maintenance strategy should have the ability to adapt the variations in business process. In my opinion, following five characteristics are essential to effective maintenance strategy;

Goal-Based

This characteristic offers maintenance strategy a top-down approach. By organizing maintenance goals around corporate business strategy, maintenance becomes a corporate culture instead of one group's responsibility. Maintenance resources can be allocated to address "what need to be achieved" rather than "what need to be done." Maintenance goals should be further break down into logical discrete sub-goals to monitor the processes at the sub-goal level.

Achievable

This characteristic offers translation of goals into clear and measureable outcomes that can be defined as 'success'. Success can be recognized and shared throughout the organization. Outcomes should be realistic and achievable based on established benchmarks and care should be taken not to over-optimize the outcomes. This can make the whole effort fruitless. For example, it is clearly impossible to achieve 100% reliability with zero cost. Perfect reliability is impractical and same is true with 100% availability or zero downtime.

Measurable

It is necessary to set and measure performance outcomes in order to determine whether the strategy is working in accordance with expectations and to identify where action may be required to enhance performance levels to meet these expectations. If a problem is identified that truly does jeopardize the business goal, the strategy process can be dynamically reconfigured. Only valid purpose of metrics is to motivate actions which improve organizational performance. Metrics should be few (5-10) and meaningful to highlight an opportunity of improvement.

Flexible

Maintenance strategies cannot be predetermined for plant's entire lifetime. Variable downtimes due to sales cycle, maximum utilization of wear-and-tear margins, and other background conditions all call for more flexible maintenance. When operational changes are made, or equipment is added or replaced, it is appropriate to adjust the goals and outcomes accordingly. Communication and feedback among maintenance, production, engineering and stockholders is essential.

Trackable

This characteristic ensures the ability of maintenance strategy to identify opportunities of improvement by ongoing measurement, analysis, and review of current practice. Maintenance program assessments may include:

- Periodic inspections of equipment and infrastructure to determine condition, operational status, aging, and housekeeping;
- Daily observations of conditions at maintenance job sites;
- Review of equipment deficiencies reported by production, engineering or others; and
- Needed work identified in the maintenance work control system.

Maintenance needs vary greatly between industries and there is no possible 'One fix to all' solution to satisfy these needs. Only by understanding the concepts and methodology of maintenance management, a meaningful framework can be decided to effectively utilize the maintenance resources to maintain equipment functions at required performance levels.

Conclusion

I hope this paper has provided some insight into the details behind failure of costly investments in maintenance improvement and predictive maintenance programs. An effective maintenance strategy is a pre-requisite for maintenance improvement programs. Without connecting and integrating maintenance improvement programs with an effective maintenance strategy, desired outcomes or improvements cannot be achieved.

Suggested Reading

1. "Uptime – Strategies for excellence in Maintenance Management" by John Dixon
2. "Maintenance Planning and Scheduling Handbook" by Bruce Hawkins and Timothy Kister
3. "RCM-Gateway to world class maintenance" by Anthony M. Smith and Glenn Hincheliffe
4. "Developing Performance Indicators for Managing Management" by Terry Wireman
5. "Influence on the approach and cost benefit of maintenance requirement analysis – RCM", Burhan Zafar
6. "Risk-Based Strategies for the Next Generation of Maintenance and Inspection Programs" by Christopher M. Serratella, Ge Wang, Robert Conachey - American Bureau of Shipping, USA
7. "Reliability-centered Maintenance -II ,Moubray, John
8. "Intangible benefits of Reliability Centered Maintenance" , Bowler D.J. Maintenance Journal Vol.9 #4
9. "Principle of Plant Maintenance", Edward Arnold
10. "Performance Indices – Do they help with decision making ?", Dwight R.A