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HOW TO CHOOSE THE BEST MAINTENANCE STRATEGY FOR A COMPANY

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Abstract: Depending on the type of system or company considered, some predictive maintenance policies perform better than others. The best policy must be determined by the analysis of the given system using adequate tools and models. The model must allow several types of failures and maintenances to be incorporated into the analysis and also allows the user to enter a set of data describing the manufacturing system or company under study, simulates the system until selected statistical criteria are satisfied and obtains output results at least in the form of specific recommendations for productivity increase.

1. INTRODUCTION

According to the dictionary, maintenance includes "all of everything that can maintain or restore a system in working order". Faced with this first definition, the basic courses in maintenance provides a more accurate maintenance indicating that the maintenance includes all technical activities, administrative or management which are intended to "maintain or restore equipment a state or condition data dependability to perform a required function". Maintenance activity is often linked to failure of a good. A good is defined as "any item, component, mechanism, subsystem, functional unit, equipment or system that can be considered individually" and failure is defined as "the alteration or termination of the ability of a item to perform a required function".

Within a company, multiple functions coexist in the goal of producing goods or services. The maintenance function provides support to the production process of the firm, maintaining the means of production and infrastructure. Maintenance has a transverse position in the company since it does not contribute directly to production process but is a support. This leads to the transverse position to have a relationship closely with the production with which conflicts may arise when organizing activities maintenance compared to production.

Modern manufacturing systems generally consist of automated and flexible machines or industrial equipments, which operate at much higher rates than the traditional or conventional machines. As a result of this higher utilization rates, automated manufacturing systems may incur four times more wear and tear than traditional manufacturing systems. The effect of such an accelerated usage consists in higher failure rates, which in turn would increase the importance of maintenance and maintenance-related activities as well as effective maintenance management. For this reason, the amount of money that companies spent yearly on maintenance can be as large as the net income earned [5].

While maintenance actions can reduce the effects of breakdowns due to wear-outs, random failures are still unavoidable. Therefore, it is important to understand the implications of a given maintenance plan on a system before the implementation of such a plan. In any case, the importance of maintenance function has increased due to its role in keeping and improving the equipment availability, product quality, safety requirements, and plant cost-effectiveness levels since maintenance costs constitute an important part of the operating budget of manufacturing company [1].

2. MAINTENANCE STRATEGY

To make a choice you must first know the whole range of concepts available and then you have defined the selection criteria and finally the optimization method used. This paper tries to summarize and understand the methodology of choosing the best maintenance strategies appropriate to a company.

In conjunction with the definition of maintainability, work has addressed the notion of maintainability criteria found in a lot of scientific paper and books. These criteria are five in number:

- supervision of preventive maintenance and component availability,
- Different time of corrective maintenance, in terms of troubleshooting, failure or diagnostic
- The maintenance organization, with the periodicity of preventive interventions, the presence of indicators, the intervention complexity etc.
- The quality of intangible resources to helping the intervention,
- Monitoring of equipment by the manufacturer.

Most of the previous studies, which deal with maintenance modeling and optimization [2], [3], [6], have concentrated on finding an optimum balance between the costs and benefits of preventive maintenance. In this paper, procedures that combine analytical and simulation models to analyze the effects of corrective, preventive, opportunistic, and other maintenance strategies on performance of modern manufacturing systems are presented in order to serve the best choice for the concrete company.

A maintenance strategy reflects how the failure is considered. Treatment of failure can be done in two ways: intervention before failure, it is then preventive maintenance or after failure and is corrective maintenance. These are the two forms of maintenance, (preventive and corrective) which are the two keywords (maintain and restore) of maintenance definition that can decompose and represent as shown in Figure 1.

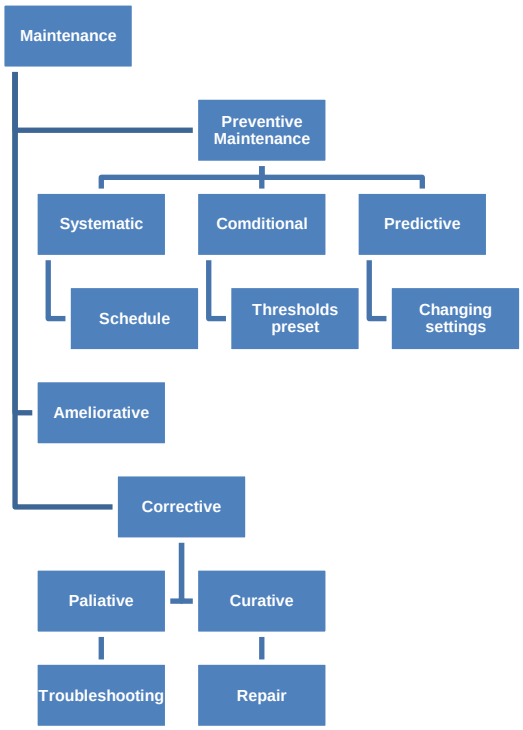

Figure 1. Conventional maintenance strategies

Corrective maintenance is the maintenance of a more "traditional “because it operates after the onset of failure. This maintenance can result in two intervention types. The first type is tentative, with palliative surgery (simple repairs). The second type is final, with curative interventions (repairs aimed at permanent removal of failures). Corrective maintenance is dependent on the randomness of failures; it is not programmable and requires the availability of adequate human and material resources.

Preventive maintenance is an evolution of traditional maintenance services. It aimed at reducing losses due to failures and advised before they happen. There are several types of preventive maintenance:

– Systematic maintenance, organized according to a schedule, planned in time; it is simple to implement but can be costly because the interventions are not always justified;

– Conditional preventive maintenance, responding to the crossing of a threshold detected by a sensor, causing interference and can be applied to any system with a sensor detects an anomaly or a deviation;

– Predictive maintenance (or forecast), based on monitoring equipment and analysis periodically to determine the trend of degradation and estimate the intervention period; it maximizes the interval between repairs.

Maintenance improvement (ameliorative) aims to increase the reliability, maintainability, availability and security equipment or a subset. This type of maintenance is one of the interventions high maintenance, with the renovation and refurbishment.

The changes caused by IT are encountered both in preventive maintenance and corrective maintenance. As a preventive measure, IT, for example, makes statements remote information, especially for predictive. IT also helps in dismantling making accessible documentation of the remote equipment. In patch, ICT can also help the establishment of diagnosis.

3. METHODS OF OPTIMIZING MAINTENANCE STRATEGIES

Maintenance strategies can specify the overall objective of maintenance interventions. Optimization of these strategies helps clarify and improve procedures of intervention and treatment of failures of maintained equipment. These methods allow also improve the instrumentation of new technologies based on IT.

Let’s consider now the methods and strategies of conventional maintenance methods optimization. There are several types of optimization methods and it will present here only the most known and used in companies. These maintenance procedures can be classified into three main categories.

These are, firstly, methods focusing on equipment reliability: (method after aircraft industry), RCM (reliability centered maintenance) and MOR (maintenance optimization by reliable). The original goal common to these methods is ensure the safety of equipment for which failure is not permitted during their operation.

Then we can cite the methods focused on the risks: methods "Risk Based", MOR-Structures (application to pipes and support elements of nuclear power plants). Unlike methods based on reliability, these methods are based on an analysis of areas priority for inspection of the risk of failure.

Finally, methods focused on the organization of maintenance activities can help optimizing maintenance strategies. For example, methods of Japanese Kaisen (TQM, 5S, JIT, SMED etc.) or continuous improvement, even without specific maintenance, have contributed to the TPM (Total Productive Maintenance). TPM has objective to achieve a maximum of maintenance tasks by the production operator working on the equipment concerned, by implementing a policy of staff motivation, improvement of working environment and commitment to progress action [5]. The features of IT to make available

information can be remote compared to the TPM. Like the TPM which strengthens the partnership operator / maintainer, IT enables the operator to benefit from the knowledge of the maintainer and maintainer of those experts remote from the place of intervention.

4. METHODS OF MAINTENANCE MANAGEMENT

Maintenance can be performed in different ways, using different methods and may follow of different management methods. Some specialist proposes a distinction between the methods of maintenance activities management into three categories:
- how internally, with a service company dedicated to maintenance by methods and strategies desired by the company,
- how do: outsource maintenance work to another company, usually specializing in maintenance,
- do it together: co-contractor maintenance operations with another company as part cooperation agreements, based on a combination of resources. Part of maintenance operations will be conducted by internal resources belonging to the enterprise (e.g. corrective interventions cannot be foreseen and planned in advance) while outsourcing other interventions requiring resources held by the partner (example: preventive interventions). The total or partial outsourcing of maintenance activities can improve intervention, reducing response times and costs associated with holding in-house expensive resources, increasing reliability of equipment etc.

5 CONCLUSIONS

The best maintenance strategy must be determined by the analysis of the given system using adequate tools and models. The model must consider the real condition being in company and allow several types of failures and maintenances to be incorporated into the analysis and also allows the user to enter a set of data describing the manufacturing system or company under study, simulates the system until selected statistical criteria are satisfied and obtains output results at least in the form of specific recommendations for productivity increase

The integration of IT in maintenance should improve service performance in including increasing the availability of equipment maintained while minimizing the resources used. The main feature of IT is to make available and accessible resource remote. In maintenance, resources and, more particularly, intangible resources are a major issue in the implementation of interventions. IT can allow access via an Internet network from the site as intervention resources are not present locally (delocalized) but which may prove crucial in resolving the intervention -this will be the future maintenance?

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