Technical Proceedings of National Symposium on
Recent Developments in Industrial Maintenance Management
April 22nd, 2006 SIET, Dhenkanal

APPLICATION OF INTERNET TECHNOLOGIES IN THE FIELD OF INDUSTRIAL MAINTENANCE MANAGEMENT

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Abstract: - *In future Internet technologies are likely to have an impact on specific industrial activities. Maintenance has long been the neglected in industry despite being indispensable both in continuous process manufacturing and in batch production. Maintenance has two key functions that can be related to management disciplines. These are the acquisitions of spare parts, which are attached to purchase and the deployment of technicians, engineers and subcontractor personnel which are jointly supervised by production, purchasing and human resource managers. The present paper highlights how Internet technology can be applied to the Maintenance Management.*

1 Introduction

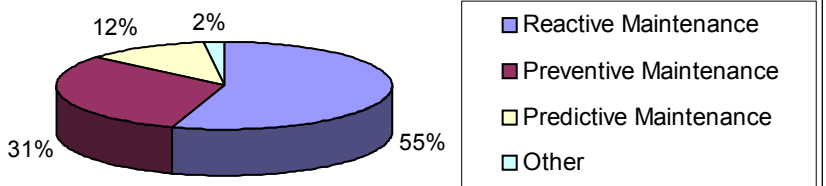
This paper deals with the opportunities the Internet can offer to the maintenance industry. Maintenance means primarily maintenance repair and operations within an industrial production environment. In the past maintenance departments have existed to remedy breakdowns. This was a rather expansive practice because breakdowns can cause standstills that cost and therefore new ways of doing maintenance appeared. The new vision was to prevent these breakdowns in order to reduce costs incurred due to excessive downtime. Preventive maintenance was the first technique to obtain this goal. It was based on the belief that it was less expensive to replace machinery parts on a regular basis than to wait until they finally broke. Predictive maintenance goes even further. This new method enables users to detect minor defects or irregularities in the machinery with different types of sensors. This new method requires sophisticated technical equipment. Still this is worth the investment because predictive maintenance payback is achieved since only those spare parts that need to be replaced are changed when necessary. With the implementation of Computerized Maintenance Management Systems (CMMS), maintenance professionals can now register information related to their activities in a computerized format. Even the data from predictive maintenance can be brought into the system and elaborated upon. These technological innovations have accompanied the wave of outsourcing that has been witnessed over recent years. Indeed due to the complexity of the work, it is sometimes financially more attractive to outsource certain tasks. The question that needs to be answered is: How can new Internet Technology improve maintenance practices. This paper is to provide a strategic insight into the possibilities of using the Internet in maintenance. Internet tools that are interesting are remote consulting and information about accreditations and norms. Providing knowledge management seems the appropriate way to provide added value by using the Internet in maintenance.

2 The Maintenance Industry Past and Present.

Maintenance used to be an unwanted department of a company. Most operations required for immediate undertaking without preparation. Inventiveness and good hammering were two of the core competence needed to be a good maintenance technician. In the past maintenance costs in India companies were between 3% and 15 % of sales. The proportion

is now significantly higher. In recent years a typical manufacturer is using about 55% towards reactive maintenance and 31% towards preventive maintenance practices. Most industrial companies are adopting these new technologies and working methods. The question is: what is next? This paper looks at the Internet as a possible next step to innovation.

Figure 1: Maintenance Activity Typologies



Overtime, constituted on an average 15% of the total working time in maintenance organizations. This figure is relatively high. Since maintenance is putting in so much overtime, it confirms the reactive approach that is usual in industry. Reducing overtime is essential if a maintenance organization is to be truly cost-effective.

3 Present Maintenance Practice

Presently maintenance costs are ranging from 3% to 15% of sales and from 2 to 12% of product costs and are probably the largest, uncontrollable cost in a plant. This clearly shows that the importance of reliability and maintenance practices has been changing. A few years ago, most organizations were often reacting to failures and the best practice was preventive maintenance programs designed to maintain equipment in good condition. Today's environment has shifted focus to predictive and proactive maintenance approaches. Programs such as Total Productive Maintenance (TPM) and Reliability Centred Maintenance (RCM) are being implemented. Best practices involve monitoring the condition of equipment, performing failure modes effects analysis (FMEA) to determine root causes of failure, and training, developing, and involving operators to lower equipment-related costs and to increase the value added in production.

The players on the maintenance market have also changed. This change highlights the new strategic importance manufacturers are willing to give to maintenance. The most important players are: manufacturers or industrial end-users, suppliers of spare parts, machinery manufacturers, consultants, and maintenance outsourcing.

1.	Manual Incident Reports
2.	CMMS
3.	Remote Maintenance Technologies
4.	Web-Based CMMS Knowledge Management

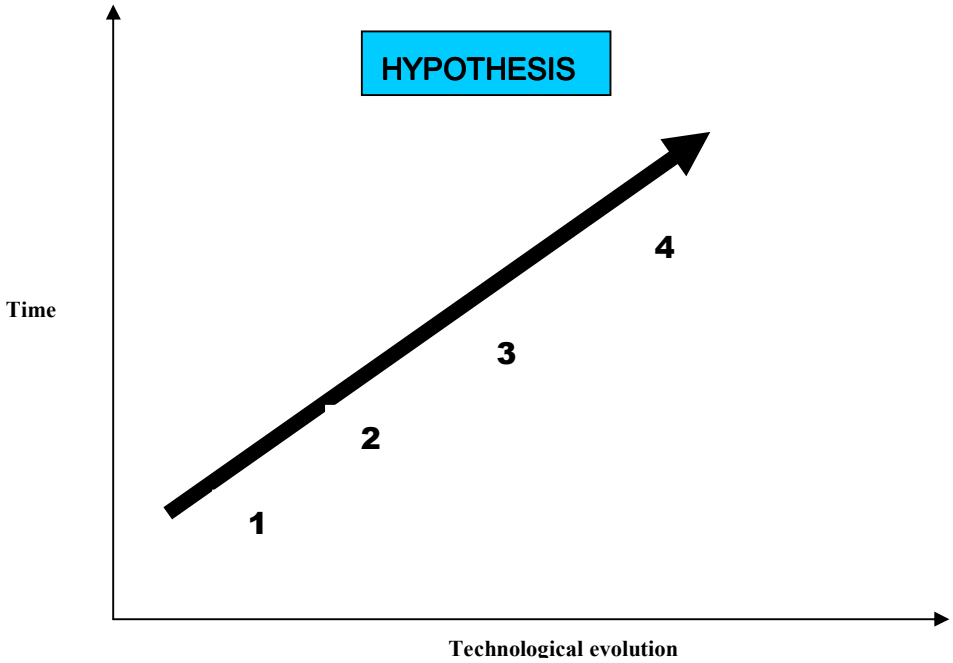


Figure 2: Predicted Evolution of Maintenance Management

4 Present Day Maintenance Practice

4.1 Computerized Maintenance Management Systems (CMMS)

CMMS systems keep track of all maintenance data and actions in a factory. The most important features of such a program are the following:

Data Analysis
Upgrade Possibilities
Asset Management
Work Management
Resource Management:
Reporting
Information Exchange

4.2 How Are CMMS Really Used?

Computerized Maintenance Management System (CMMS) has to manage equipment, material, labour and cost data in order to manage maintenance as a key part of the total operation. Even though a CMMS provides the system tools and the information framework to integrate best practices into the maintenance process, it is most successful in organizations that are committed to a long-term maintenance strategic plan to improve maintenance practices and procedures.

4.3 Subcontracting

Contracting out of selected maintenance activities is strategically important. Another SMRP survey (2000) shows that 81% of plants are presently subcontracting some maintenance work to a third party with an average of 25% of the total maintenance budget

spent on contractors. Best practices imply a clear and well-defined contracting philosophy and contractor management process. Seventy-five percent of plants using contractors (63% of all plants) agree there is a clear and well-defined contracting strategy, and 39% of these plants (33% of all plants) have an established set of indices to measure contracting performance. Safety indices, quality of work, and schedule compliance are the most common contractor performance measures.

5 Maintenance Typologies

Traditional curative methods are now increasingly superseded by preventive and predictive techniques.

5.1 Preventive Maintenance

Preventive maintenance has been in use for some decades now. In most companies the benefits of this procedure were commonly known and accepted. Though the basic principal was to replace mechanical parts before they fail and standstill it has become clear that in many cases replacements were unnecessary and therefore expensive.

5.2 Predictive Maintenance

The use of sound, smell, vision and touch to detect symptoms of a bad bearing or misalignment made the development of sophisticated gadgets possible that now can sense problems long before they become obvious to us. Modern predictive maintenance equipment uses the following approaches to monitor plant machinery performance.

- Vibration sensors
- Oil analysis
- Infrared thermograph
- Ultrasound sensing equipment

6 Capabilities of Predictive Maintenance Technology

Recent developments in the technology of monitoring machinery to predict maintenance, schedule repairs and minimize downtime have created effective systems for breakdown prediction. Sensing and predicting potential problems in motors, pumps and gearboxes is nothing new. Most maintenance and operations departments are familiar with using vibration analysis, oil sample analysis, and infrared sensing and ultrasound monitoring to track equipment performance. Experts in the predictive maintenance field estimate that up to 75 percent of manufacturing companies in developed countries like U.S. use some form of predictive maintenance techniques.

Companies carry out predictive maintenance in a variety of ways. Large companies can often justify owning the sensory equipment and training employees to operate it although the outsourcing way in many bigger companies is putting this activity in the hands of outside contractors. Many smaller companies have found outside contractors a cost-effective way to monitor their equipment's performance. To make predictive maintenance technologies cost-effective, the first step is to decide which pieces of production or support equipment are critical. Many people in the predictive maintenance industry cite the 20-80 rules, which state that only 20 percent of the equipment in a facility is absolutely critical to keep things running. The other 80 percent "only" slow things down or make life difficult if they fail or develop problems. The goal should be to identify critical equipment and initially spend resources monitoring it instead of trying to monitor everything in the plant.

7 Spot-Checking and Continuous Checking

As the price of portable predictive sensing equipment drops, the temptation to monitor everything that moves in the plant increases. Workers are often given vibration or infrared detectors and sent on a mission to check every motor, pump and valve in a plant. The result: a massive data bulge that overwhelms any attempt to monitor and develop a predictive maintenance program. In leading-edge asset management systems, vibration and temperature sensing equipment constantly monitor critical motors, pumps and related equipment. Instead of spot-checking equipment once a week or once a month for excess vibration, data is collected continuously. Spot-checking catches equipment as it is failing and online asset management gives you data that helps analyse why it is failing.

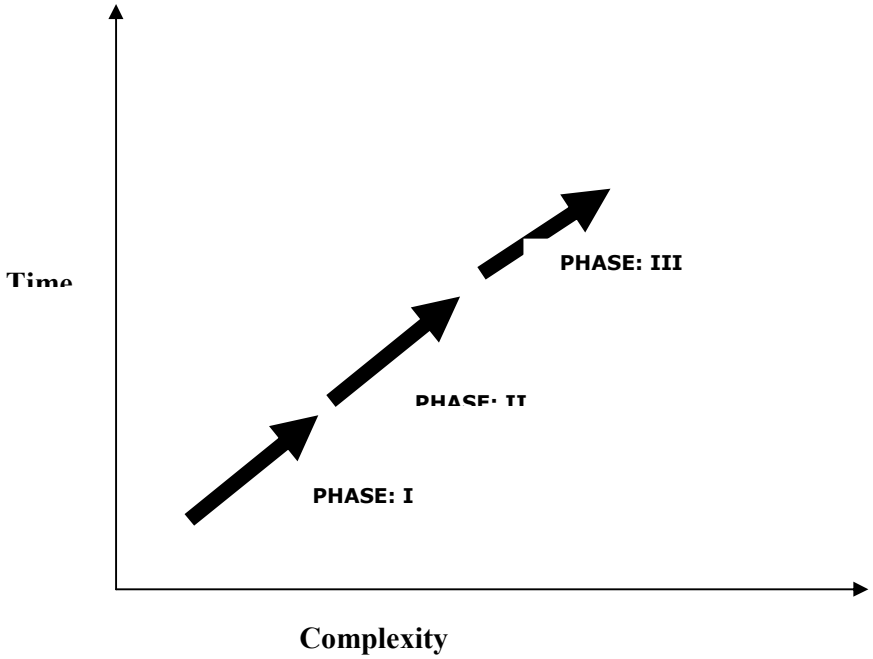


Figure 2: Evolution of Maintenance Typologies

		OBJECTIVE:
PHASE: I	**Curative Maintenance**	**Respond to Breakdowns**
PHASE: II	**Preventive Maintenance**	**Avoid breakdowns by Taking pre-emptive Measures**
PHASE: III	**Predictive Maintenance**	**Optimise costs and respond effectively While increasing knowledge related to industrial assets**

8 Internet Application to Maintenance Management

In this section the main possibilities of Internet Technology for addressing maintenance issues will be dealt with. Most of them are still in beginning phase in the real world but the technological platforms are already there.

8.1 Remote Maintenance

As predictive maintenance uses data, which is transmittable by a network, it offers the opportunity to keep an eye on machinery from a distance. Costs will normally drop as wireless technology comes online. The initial cost of system components will be higher, but the installation cost will be minimal compared with the costs of hard-wired systems of purchasing.

8.2 Knowledge *Management*

Here knowledge management is called the accumulation of experience and knowledge that goes beyond the simple quantitative indicators that are generated by information systems such as Computerized Maintenance Management System (CMMS). The mere deployment of such information technologies is no guarantee of industrial security.

Conclusion

Clearly the technological possibilities for an industry are huge. The benefits from predictive maintenance, Computerized Maintenance Management System (CMMS) and professional outsourcing are more and more accepted and implemented. Internet can be seen as the next step interest for online services is mainly in knowledge-related fields. Information systems are surfacing as the lead management tool of the decade. Yet, maintenance players are not taking advantage of this technology to help them gather, store and disseminate information. The Internet's primary function is to enable fast and easy information transmission. Information is something that is needed in maintenance departments on an everyday basis. Clearly the opportunities afforded by this can be implemented far more easily and more cheaply Maintenance people are not always educated to work with complex software applications and it takes, time to develop appropriate solutions and train personnel.

The future of maintenance involves a “virtual” workforce. The virtual maintenance workforce will remain in one local area servicing more than one company. A maintenance service supplier can send out maintenance technicians to various client facilities depending on the specific maintenance task needed. Maintenance is no longer supplied in a “stand-by” mode, but is supplied on an as-needed basis. Computerize maintenance management systems and predictive maintenance technologies make this possible. The Internet will affect the maintenance industry. The possibilities the Internet provides are in many ways a solution to maintenance problems. The Internet can save money for the company by enabling cheaper outsourcing, providing the necessary information to resolve urgent problems and by purchasing spare parts faster and cheaper. Once these benefits become clear and the necessary investment money is provided, companies will switch to a more networked maintenance system.