

CHAPTER TWO

2-1 Concept of maintenance

In general maintenance is process of an inspection and repairing for any structure to increase the life time and protect it from breakdown and allure.

In the technical view maintenance mean a group of activities in purpose to make sure the status of all part of the structure in the best situation to achieve what they built for.

2-1-1 Other definition:

- It's a group of technical systems applied by maintenance department to decrease the faults and increase the efficiency of machines.

- The work which saves the production tools and equipment in standard level.

CMMS stands for “Computerized Maintenance Management System”. A CMMS system is computer software that helps maintenance teams keep a record of all assets they are responsible for, schedule and track maintenance tasks, and keep a historical record of work they perform.

All of the above definitions lead to that: maintenance is a purely technical process needs a management system which helps to reach optimal decision in the optimal time.

2-2 Why Use a CMMS?

A CMMS can keep track of past repairs, schedule future maintenance, and provide a ready list of vendors and parts sources. It can be used to generate detailed work orders for maintenance personnel. These work orders can contain specific safety precautions and special tools for individual jobs. A CMMS installed on a computer network can be used to manage the maintenance of several remote facilities from a central location. The ability to track historical costs and project future maintenance expenses make a CMMS useful for budgeting.

2-3 Benefits of CMMS Software

These are benefits that you will realize within the first year of implementing a CMMS. Savings from tangible benefits can be allocated directly to the Return of investment of the software. Each of these points can be measured against past data to get real Return Of Investment statistics for your operation.

1. Fewer equipment and asset breakdowns

CMMS software will give you a place to store important equipment information such as preventive maintenance schedules and procedures.

Without a CMMS, important tasks can get swept to the side or never get done causing excessive breakdowns.

2. Less labour costs

It takes more time to do corrective maintenance than preventive maintenance. If you rely solely on corrective maintenance as a maintenance strategy, you will be wasting a lot of time and exerting a lot more energy to keep equipment running. A CMMS can get your PM strategy off the ground right with organized schedules, pm procedure documentation, and work order automation. You'll be able to maintain the same amount of equipment using fewer man-hours to do it.

3. Less material and parts usage

Maintaining a part is usually less expensive than replacing it when it breaks. when you take care of the minor issues, it keeps any major maintenance problems from forming. CMMS software will make sure your team has the tools to stay on top of critical maintenance so they don't have to replace expensive components way before they are expected to fail.

4. Reduction in inventory stockpiles

Fewer parts being used means fewer parts needed on-hand for emergency repairs. Reducing inventory keeps your operations overhead manageable so you aren't throwing large

portions of your budget to parts that could have been kept running if they were subject to scheduled maintenance. CMMS inventory management will help you to manage inventory levels and set reorder points on specific items.

5. Save on paper

This is the most basic benefit of using a digital system. Paper is a huge expense in most organizations. Man-hours spent filing paper, and the time taken to enter information from paper into a computer. Most CMMS software is 100% web-based. The only papers you will handle are reports that can be printed when needed.

6. Extended equipment life-cycles

Capital equipment investments are expensive. Maintaining your equipment substantially extends their operating life, increasing the Return Of Investment of those assets. A CMMS will make sure technicians are aware of what needs to be done and when to do it, preventing premature asset failures and replacements.

7. Accurate performance measurement

CMMS software can be used by management to track different performance measures, work order processing speed/capacity, customer satisfaction, etc.

All data entered into a CMMS is stored for future reference and trending data can help management accurately measure maintenance performance over time.

2-4 Types of maintenance

1. Breakdown maintenance:

It means that people waits until equipment fails and repair it. Such a thing could be used when the equipment failure does not significantly affect the operation or production or generate any significant loss other than repair cost.

2. Preventive maintenance:

It is a daily maintenance (cleaning, inspection, oiling and re-tightening), design to retain the healthy condition of equipment and prevent failure through the prevention of deterioration, periodic inspection or equipment condition diagnosis, to measure deterioration. It is further divided into periodic maintenance and predictive maintenance. Just like human life is extended by preventive medicine, the equipment service life can be prolonged by doing preventive maintenance.

a) Periodic maintenance

Time based maintenance consists of periodically inspecting, servicing and cleaning equipment and replacing parts to prevent sudden failure and process problems.

b) Predictive maintenance

This is a method in which the service life or important part is predicted based on inspection or diagnosis, in order to use the parts to the limit of their service life. Compared to periodic maintenance, predictive maintenance is condition based maintenance. It manages trend values, by measuring and analyzing data about deterioration and employs a surveillance system, designed to monitor conditions through an on-line system.

3. Corrective maintenance:

It improves equipment and its components. Equipment with design weakness must be redesigned to improving maintainability.

4. Maintenance prevention:

It indicates the design of new equipment. Weakness of current machines are sufficiently studied (on site information leading to failure prevention, easier maintenance and prevents of defects, safety and ease of manufacturing) and are incorporated before commissioning a new equipment.

2-5 Maintenance management system

Maintenance Management is an orderly and systematic approach to planning, organizing, monitoring and evaluating maintenance activities and their costs. A good maintenance management system coupled with knowledgeable and capable maintenance staff can prevent health and safety problems and environmental damage, yield longer asset life with fewer breakdowns, and result in lower operating costs and a higher quality of life.

There is a lot of work required to set up a successful maintenance management system. However, once it is in place, most of the data and calculations remain the same from year to year. Changes are required only when there is an addition or deletion to the inventory or when cost increases and estimates need to be corrected. In these cases, the appropriate work orders and schedule must be revised and the labor, equipment, material and contract costs updated for the New Year. There are numerous computerized maintenance management systems available in the commercial market to assist in effectively managing the maintenance of on- reserve assets.

The maintenance supervisor or manager must also monitor the work progress daily, weekly or monthly depending on the nature of the situation and the potential impact of a service breakdown to the community. He or she must not wait until the

year end to review the budget, as it would be too late to take any corrective action if it were necessary. Any significant variance in labor hours, work order costs or total maintenance cost for a particular asset should be identified through exception reporting. The supervisor should determine the cause of the variance and, where possible, develop alternative solutions or actions to reduce time and costs. Taking these steps will help improve the efficiency and effectiveness of the maintenance program.

The figure (2-1) below shows the factors affect in maintenance process.

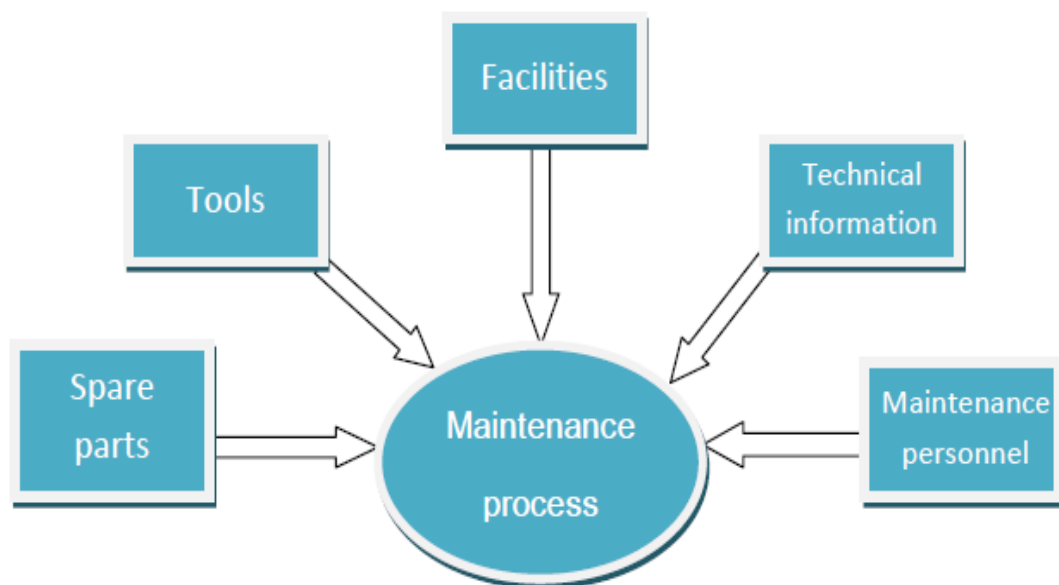


Figure (2-1) the factors affect in maintenance process

2-6 Computerized maintenance management system (CMMS):

Computerized Maintenance Management System CMMS are computer soft are that helps maintenance teams keep a record or all assets they are responsible for, to schedule and track maintenance tasks and to keep a historical record of work they performed as shown in figure (2-2).

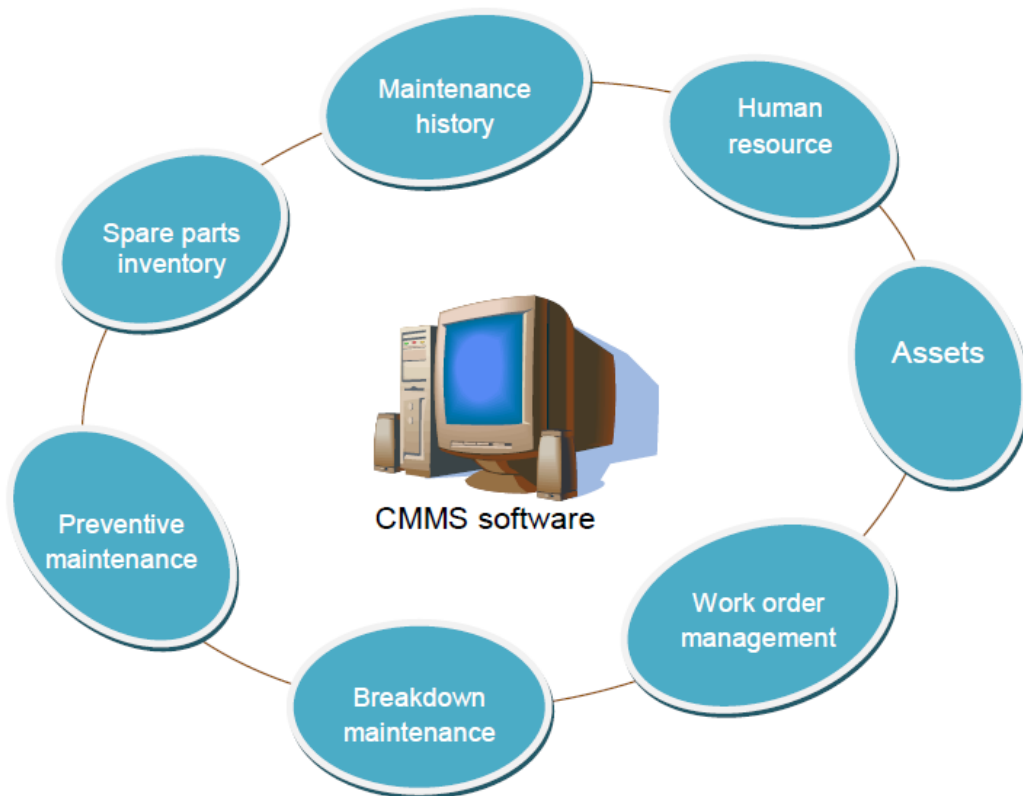


Figure (2-2) computerized maintenance management system

2-7 Who uses CMMS systems?

Just about every kind of industry requires maintenance and CMMS systems help record and plan that maintenance. There are 4 major types of users for these systems

- **Production maintenance:** These are companies that make tangible products. They have machines, assembly lines, forklifts, and heavy equipment that require frequent maintenance.
- **Facility maintenance:** These are companies that take care of buildings. Apartment buildings, theatres, and government buildings all require maintenance. CMMS systems help them deal with structural, HVAC, and water-supply problems.
- **Fleet maintenance:** These are companies that take care of vehicles and transportation. Car rental companies, pizza delivery cars, city buses, transport ships, and fleets of towing trucks all need to have repairs scheduled which can be taken care of with a CMMS system.
- **Linear asset maintenance:** This is a special category of maintenance for companies that have assets that are kilometers long. For example, a city's linear assets are roads and water pipes, a telecom company needs to maintain fiber-optic cabling, and an energy utility needs to maintain long spans of electrical wiring.

2-8 What CMMS is used for?

2-8-1 Tracking Work-Orders:

Maintenance managers can select equipment with a problem, describe the problem and assign a specific technician to do the work. When the machine is fixed, the responsible technician marks the work-order “complete” and the manager gets notified that the work is done.

2-8-2 Scheduling Tasks:

As a team starts to schedule preventive maintenance in advance, they need a reliable work calendar. CMMS systems are especially good at scheduling recurring work and sending reminders to the right people. Organized scheduling helps even out the workload for a maintenance team, and makes sure that tasks don't get forgotten.

2-8-3 Recording Asset History:

Many maintenance teams have to care for assets that are 10, 20, even 30 years old. These machines have a long history of repairs.

When a problem comes up, it is always useful to see how this problem was solved last time. In CMMS systems, when repairs are done, they are recorded in the machine's history log

and can be viewed again by workers. This saves a lot of time - technicians can rely on past experience to solve problems.

2-8-4 External Work-Requests:

Maintenance teams often have to take a work-request from people outside the team. This can be a request from an assembly line operator who is hearing a strange noise from a drill. The CMMS is a central place for recording these requests and tracking their completion

2-8-5 Managing Inventory:

You might not think about it at first, but maintenance people have to store and manage a lot of inventory: spare parts for machines, and supplies like oil and grease. CMMS systems let the team see how many items are in storage, how many were used in repairs and when new ones need to be ordered. This inventory management ability saves the organization a lot of money, because purchases can be pre-planned (shopping around for savings) instead of done last-minute (paying any price just to have the component now).

2-9 The future of CMMS:

Modern CMMS companies are focusing on these areas as a direction for future development

2-9-1 Mobile CMMS applications:

Maintenance workers spend most of their time outside the office fixing machines and taking care of buildings. Making the CMMS available in the field on their mobile phone is a great benefit. With a mobile interface to the CMMS, the technicians can record what they are doing as they are doing it, recording pictures of the work and requesting help onsite.

2-9-2 Easy-to-use CMMS software:

Many established CMMS companies make products that are very difficult to use. The interface hasn't changed since the late 1990's and many unnecessary, complicated features have been added to the product. More innovative CMMS companies often try to simplify the maintenance process and to make the software easy to use.

2-9-3 Fast CMMS data entry:

The majority of CMMS projects that fail, do so because it is too difficult and time consuming to enter data into the system. The next frontier in CMMS design centers around designing intuitive, efficient ways to enter data into the system.

2-9-4 Web-based CMMS systems:

Older CMMS systems are based on a downloadable piece of software, which needs to run on a server at the customer's company. New CMMS companies are mostly focused on providing a private CMMS system for their clients which runs online in the cloud. The fact that the CMMS provider takes care

of all the IT, security, and backups appeals to many maintenance teams

2-10 Previous Studies:

2-10-1 First Study:

“Implementation and benefits of introducing a computerized maintenance management system into a textile manufacturing company” The case study was based on a CMMS implementation in a textile manufacturing company in the south west of Ireland. The company had employee numbers of 110 persons at the time of CMMS implementation. There were a total of nine technicians and a maintenance manager making up the maintenance department.

Existing maintenance within the company was a mixture of ‘repair’ type maintenance and planned maintenance across the various departments. There was anecdotal evidence to suggest that maintenance was conducted in the plant across all departments, records of which were not always documented, this being one of the major disadvantages associated with manual systems. Analysis of breakdown and cost was not frequently carried out.

CMMS implementation results and analysis and evaluation of the CMMS implementation was carried out after 7 months of successful operation of the system. All-major targets were achieved by a successful implementation of CMMS software.

The cost of spares reduced while production increased. As shown in figure (2-3).

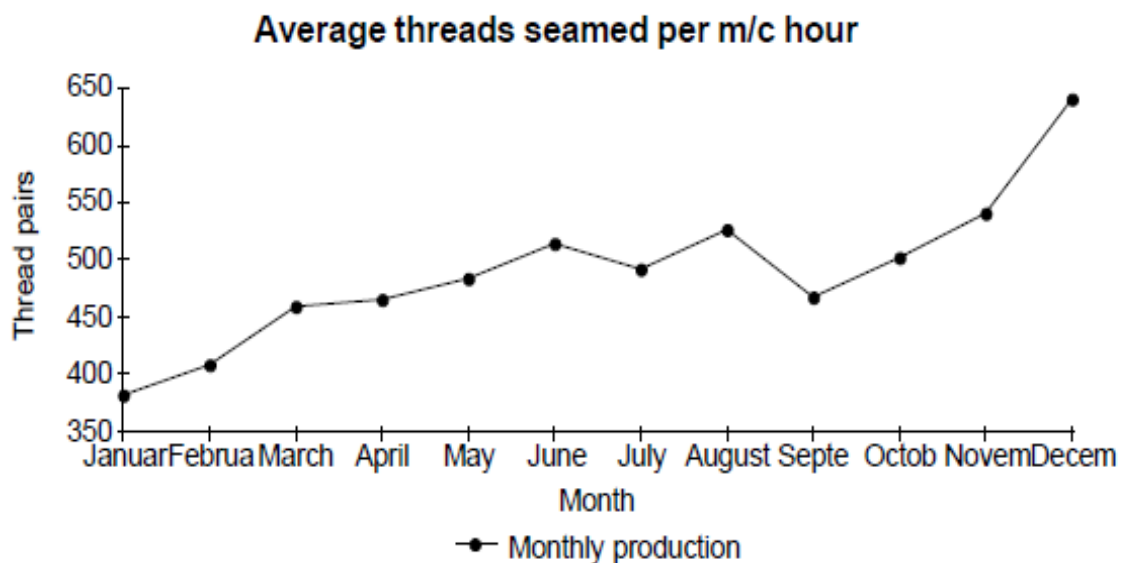


figure (2-3) Increase in production

The recommendation that have been reached that Many benefits accrued from the CMMS implementation after 7 months in operation such as reduced cost of spares, uptime improvements, increased equipment availability, reducing lead times, increased morale, reduction in unscheduled maintenance and streamlining of work orders schedules. Evidence of these benefits was supported by several key performance indicators, which were evaluated. These consisted of reduced maintenance costs in the area of spare parts.

Equipment, be it sophisticated or basic in operation and design, depending on its usage, will inevitably malfunction and breakdown. Within any organization where manufacture is the primary activity, it is crucial that procedures exist for equipment maintenance. Not only does equipment maintenance need to be

planned for, the possibility and probability of breakdowns and disruption to operations must also be considered when planning and scheduling production.

2-10-2 second Study:

“Technology adoption: A study on post-implementation perceptions and acceptance of computerized maintenance management systems”

Research question: Does user perception influence the acceptance of technology, if so, how can user perception, and the acceptance of CMMS be measured?

This paper briefly describes a study designed to examine post implementation perception and acceptance of CMMS by users.

The primary assumptions are that plausible definitions for user perception and acceptance exist, and that these two factors can be measured. The study which was conducted from the viewpoint of a CMMS implementation vendor was not longitudinal. Furthermore, the study did not consider or examine the issue of readiness of the client/user organizations. User clients were contacted to respond Sixty-five respondents were male, and 37 were female, while 52 respondents were from food processing and information technology More than 50% of the respondents had used CMMSs for more than 5 years while less than 10% respondents) had only one year user The respondents'

feedback is summarized in that most of the respondents agree, to strongly agree that the CMMS is useful and easy to use.

The study thus reiterates the view that user perception influences the acceptance of technology. This is based on the statistical significance results.

Respondents to the study indicated that ease of use, usefulness and system characteristics were strongly dependent on the level of training of the user during the implementation of the computerized maintenance management software system, thus reiterating that user training influences perception which, in turn, influences user acceptance.

This study has also provided empirical data that upholds the conventional wisdom that training has a very strong influence on how a user not only perceives and accepts a technology system but also, how the technology is utilized after it has been implemented.

The recommendation that have been reached that train workers on the use of maintenance programs have a significant impact on the decision of acceptance of the technology.