3 Managing a CMMS project & codification

III.1 INTRODUCTION

Faced with the diversity of equipment in an installation and their behavior, maintenance managers must consider real strategies. They may decide to carry out corrective maintenance following equipment failure, but this does not prevent the consequences of breakdowns on the operation of the system. A more offensive attitude consists of implementing systematic preventive maintenance according to which the decision to intervene precedes the appearance of the malfunction. This reduces the number of failures and induces a substantial economic gain, a consequence of the difference between the costs generated by the intervention and the availability it causes.

The degradation mechanisms can be of several types: wear, fatigue, aging, various physicochemical alterations, etc. Their kinetics of evolution (function of operating time, calendar time or even the number of requests) can depend of several influential factors (environmental and operating conditions, degradation of other equipment, reliability maintenance task, etc.) [21]. Failure modes describe the malfunction of a piece of equipment due to the function it no longer performs. Five generic failure modes are defined, [22]: loss of function, unintended operation, refusal to stop, refusal to start, degraded operation.

The company has capital in the form of equity and borrowed funds, which it transforms into fixed assets (premises, production materials, various equipment). These goods make it possible to manufacture products based on the total cost of production, plus sales expenses, miscellaneous expenses and profit. Production cost consists of raw material cost, manufacturing cost and maintenance cost. The maintenance cost consists of labor cost, spare parts cost and subcontracted work cost. The following synoptic table below (Table III.1) provides a better understanding of the cost structure in general.

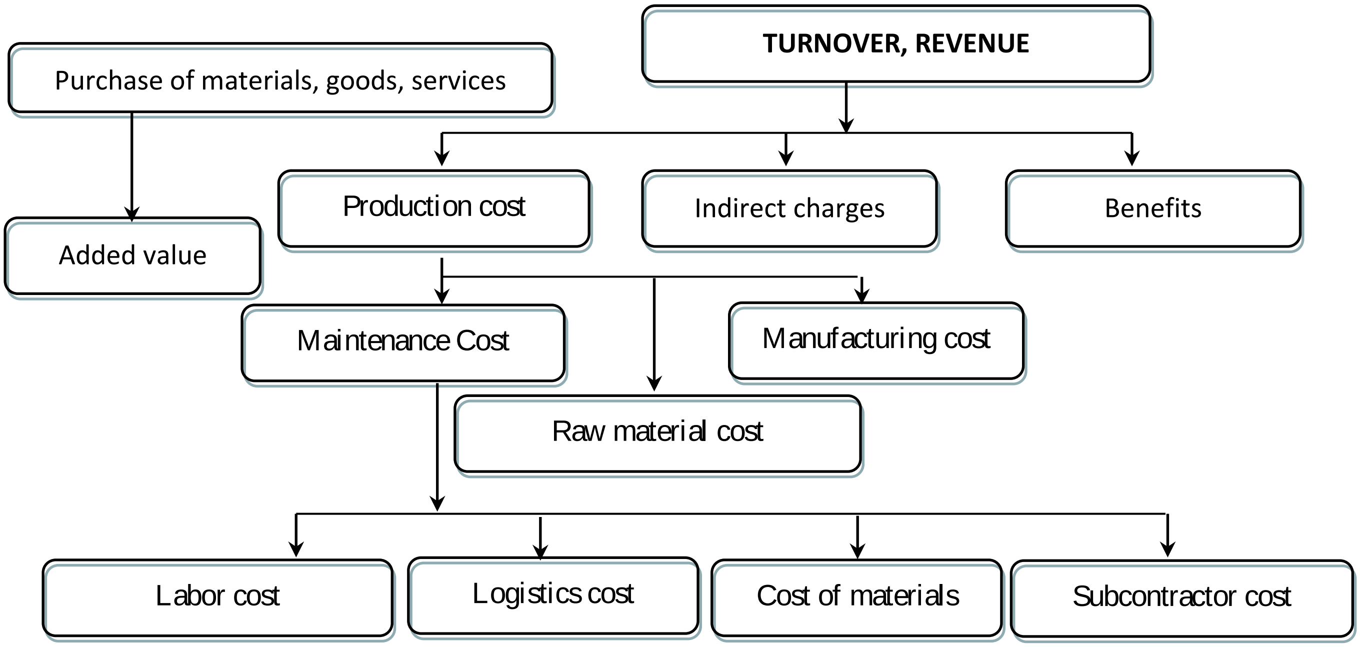


Fig. III.1 Summary table of costs

III.2 SOME DEFINITIONS:

III.2.1 Turnover or revenue

The turnover represents the sum of all sales made by the company during a period generally corresponding to one year of activity (it is the value of overall annual sales).

III.2.2 Added value

Added value expresses a value transaction or the increase in value that the company brings to goods and services from third parties in the exercise of its current professional activities. It represents the value of the transformation of a working material into a finished product, it is an economic characteristic [23].

It is measured by the difference between the production of the period and the consumption of goods and services supplied by third parties for this production. It is calculated as follows:

Val. Added = Sales price - (Value of total supplies, materials and services).

III.3 MAINTENANCE COSTS

Saving on maintenance costs generally ends up being expensive in production downtime and corresponding loss of revenue. Conversely, beyond a certain threshold, too high a level of maintenance is comparable to poor quality, which is expensive without necessarily bringing additional performance to production. The cost price of a product is the sum:

	Predictive Maintenance	Reactive Maintenance
Primary Goal	Predicting problems to ensure reliability and cost-savings	Allowing assets to run to failure before replacing or repairing
Cost Savings	High	Low
Benefits	Allows for holistic, knowledgeable maintenance schedule	Allows for maximum production output of asset by using it to its limits
Disadvantages	Increased upfront infrastructure management and operational costs	Cost of repairing or replacing assets can be more than the production value received by running to failure, can result in more costly repairs

The competitiveness of a company depends on its cost price. This is why it is important to reduce maintenance costs as much as possible. They include:

- Maintenance costs;
- Downtime costs.

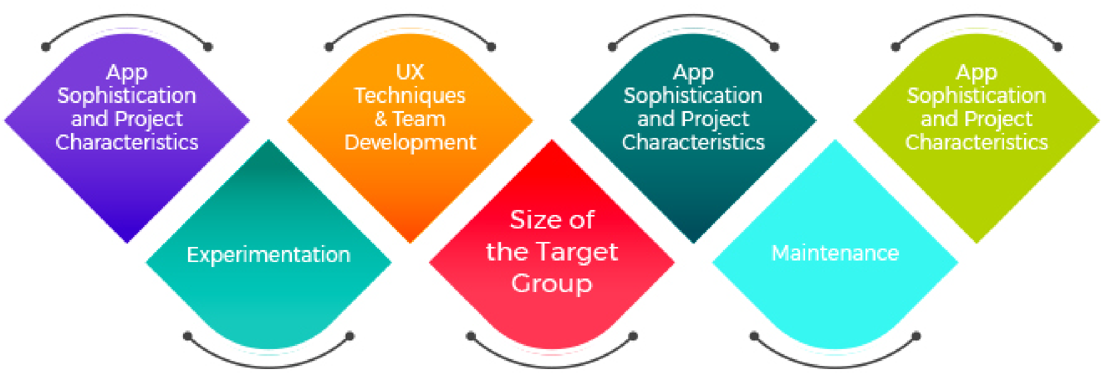


Fig. III.2 Cost branch Synoptic

III.3.1 Maintenance costs

They are multiple and concern personnel, tools and equipment, products and spare parts, subcontracting, documentation

III.3.2 Unavailability costs

Downtime costs take into account:

- The costs of production losses: they are linked to the cost of non-production (fixed costs incurred not covered by the cessation of production), to the cost of non-quality (scrap or additional cost of rework) or to the additional cost of production (storage of parts to cope with a production stoppage or replacement means implemented to make up for the delay);

- Shortfall: drop in turnover;
- Late payment penalties;
- The consequences on the company's brand image.

III.3.3 Failure costs

Failure costs include corrective maintenance costs and downtime costs resulting from the failure of capital goods.

The cost of failure is very difficult to determine precisely; in fact, all specialists are unanimous on this subject. Some parameters are subjective (drop in quality, working climate) others are subject to discussion. Should production losses be taken into account when the products exist in stock (available stock)? In any case, even an appreciable error in this failure cost does not lead to an analysis error.

On the other hand, it would be interesting to follow its evolution: a reduction constitutes an indicator of maintenance effectiveness, an increase requires the search for remedies adapted to the situation [24]. Its evolution is followed by periods. If possible, fairly short periods so as to act in the event of drift.

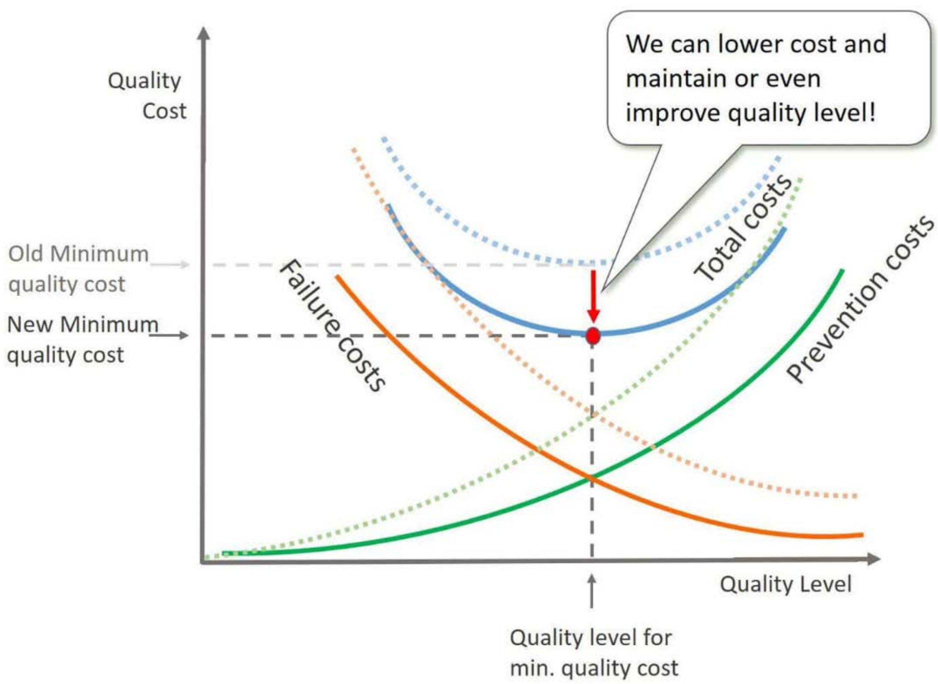


Fig. III.3 A conceptual model for the two components of the total costs of failure

Seeking to eliminate breakdowns would imply the implementation of very significant resources, therefore making maintenance costs exorbitant. We can clearly see from this analysis that production losses and maintenance expenses evolve in opposite directions: When one decreases, the other increases. Knowing that the objective to be achieved consists of minimizing the cost of failure, it will be necessary to seek the best compromise [25]. We have noted a few indicators that make it possible to monitor the evolution of the cost of failure:

- Number of stops and total hours lost for a given period,
- Number of rejects due to failure for a given period,
- Monitoring the average downtime per breakdown,
- Estimation of the quality of unmanufactured product,
- Tracking penalties for late delivery…

III.3.4 Optimization of maintenance costs

It's not all or nothing. It is true that reducing maintenance spending in a short period of time is difficult. However, it is possible to improve control over your maintenance budget with a systematic approach. The key is to **eliminate waste. This way, you eliminate tasks you are overdoing, increase productivity, and save materials.**

According to one study, 50% of maintenance costs are "waste". However, reducing maintenance spending by half requires almost superhuman efficiency. Instead, let's try to cut maintenance costs by 20%. The prime suspects for cutting costs are:

- The equipment with the highest preventive maintenance costs;
- The equipment with the highest number of work hours per year.

The equipment you spend the most time on is probably the biggest source of waste. However, **you can use these strategies to reduce maintenance costs on any asset:**

III.3.4.1 Eliminate repetitive tasks

Did you know that 30% of preventive maintenance tasks are performed too often? Not all breakdowns follow a clear pattern over time. So, unless you have established a pattern (number of cycles, quarterly or semi-annual maintenance requirement, etc), you may be over-performing maintenance.

III.3.4.2 Eliminate tasks that do not correspond to any failure mode

Another way to avoid over-maintenance is to ensure that each task corresponds to a specific failure mode. In other words, ensure that you are not scheduling maintenance tasks that do not prevent anything specific. Not sure what the failure modes are? Here's how to do a root cause analysis to better explore failure modes.

III.3.4.3 Optimize work orders

Optimizing work orders can help technicians to act faster and understand immediately what they need (protective materials, tools, etc). But there are more ways to avoid waste. For example, when you receive notifications of breakdowns, use geolocation to find out who the nearest technician is to optimize travel.

III.3.4.4 Avoid reactive maintenance

According to Reliable Plant, unplanned work takes 3 to 9 times longer. This means that reactive maintenance is not only hemorrhaging money and resources but also time. Therefore, one of the best ways to reduce maintenance costs is to avoid reactive maintenance.

III.3.5 Economic ratios

Ratios are relationships between two values. They make it possible to measure quantities relatively, to control the objectives set, to compare methods between several units or after changes in the situation. The study of ratios can take place at different levels: at the level of the company in relation to its sector of activity, at the level of developments in the company, at the level of the evolution of the maintenance service. The following table shows some ratios defined in standard NF X 60-020 [19].

Ratio	Comments
$\boldsymbol{R1 = \frac{maintenance\ Cost}{Added\ alue\ of\ the\ product}}$	The most judicious ratio for inter-company comparisons in the same sector of activity.
$\boldsymbol{R2 = \frac{Failure\ Cost}{maintenance\ Cost + Failure\ Cost}}$	Maintenance efficiency development indicator
$\boldsymbol{R3 = \frac{Cost\ of\ subcontracted\ work}{Maintenance\ Cost}}$	Allows you to monitor the load rate of the maintenance department, to be linked to the maintenance activity rate
$\boldsymbol{R4 = \frac{Failure\ Number}{Time\ functionig}}$	Definition of MTBF. Important ratio in activities where stopping the line generates significant waste or when restarting takes a long time
$\boldsymbol{R5 = \frac{Failure\ times}{Total\ Time\ functionig}}$	Importance of corrective maintenance in relation to all interventions Allows the effectiveness of the implementation of preventive measures to be judged.

Overall cost of equipment (Life Cycle Cost: LCC)

The overall cost of equipment over its entire lifespan is the difference between cumulative revenue and actual cost.

$LCC = V - (Ca + Cu + CM + \overline{CP})$ with

V: Cumulative revenue

Ca: Acquisition cost

Cu: Cumulative operating cost (materials, personnel, supplies, etc.)

CM: Cumulative maintenance costs

$\overline{CP}$: Cumulative cost of unavailability

We use a graphical representation of these values to highlight the key moments in the life of the equipment.

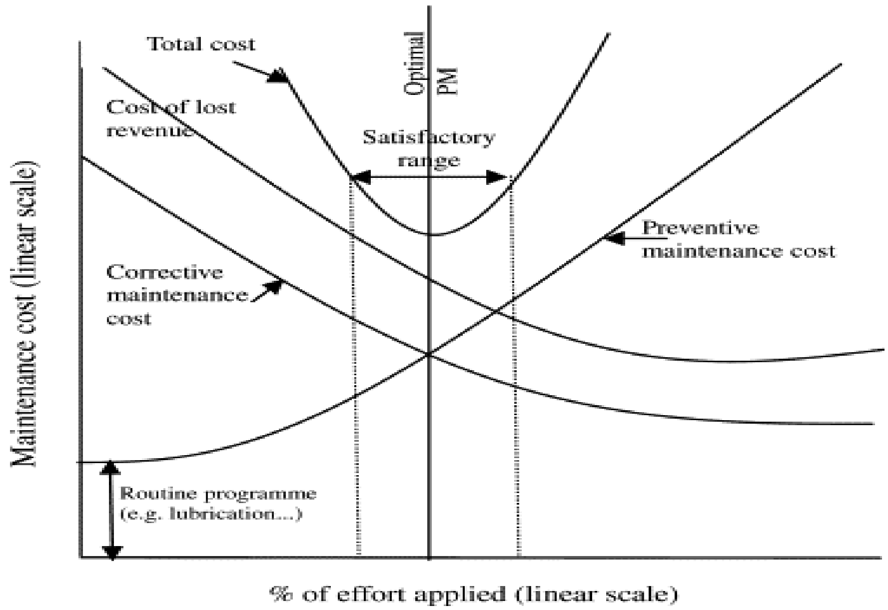
We plot on the same graph the curve of cumulative revenues and the curve of the sum of all cumulative costs. The resale value of the equipment can sometimes be subtracted from the total costs.

The overall cost is the difference between the revenue curve and the cost curve. It can be negative (the equipment is not yet profitable or has become obsolete) or positive (the equipment is profitable).

The graph allows us to determine:

- The T1 profitability threshold: this is the minimum operating time before the equipment generates a profit. This is, on the graph, the intersection between the revenue curve and the cost curve;
- The profitable period between T1 and T2: period during which the operating result is positive.
- The optimal replacement age TR: it corresponds to the minimum average annual cost.

The average annual cost is the slope of the line passing through the origin. To obtain the corresponding point, we draw the line which passes through the origin and which tangents the cost curve. We can then determine the moment at which the exploitation made it possible to generate maximum profits. Beyond that, maintenance costs will increase and reduce profits.



III.4 Maintenance policy

Defining the maintenance policies applicable in the company is an important function which begins with the definition of the different chapters of this policy depending on what is subject to maintenance. The product in use or more generally the after-sales service or support logistics

III.4.1 Maintenance levels

Another element of the maintenance policy takes into account that there are different levels for maintenance operations. We go so far as to define 5 maintenance levels but we can broadly group them into three types

- Operator maintenance replacement of headlight bulbs level control replacement of filters in the case of a truck fleet for example
- Specialized maintenance replacement of glow plugs adjustment of the injection pump replacement of brake discs in the same example
- Heavy maintenance complete engine overhaul operation annual visits etc.

III.4.2 Equipment maintenance policy

Defining the maintenance policy for equipment consists of voluntarily deciding:

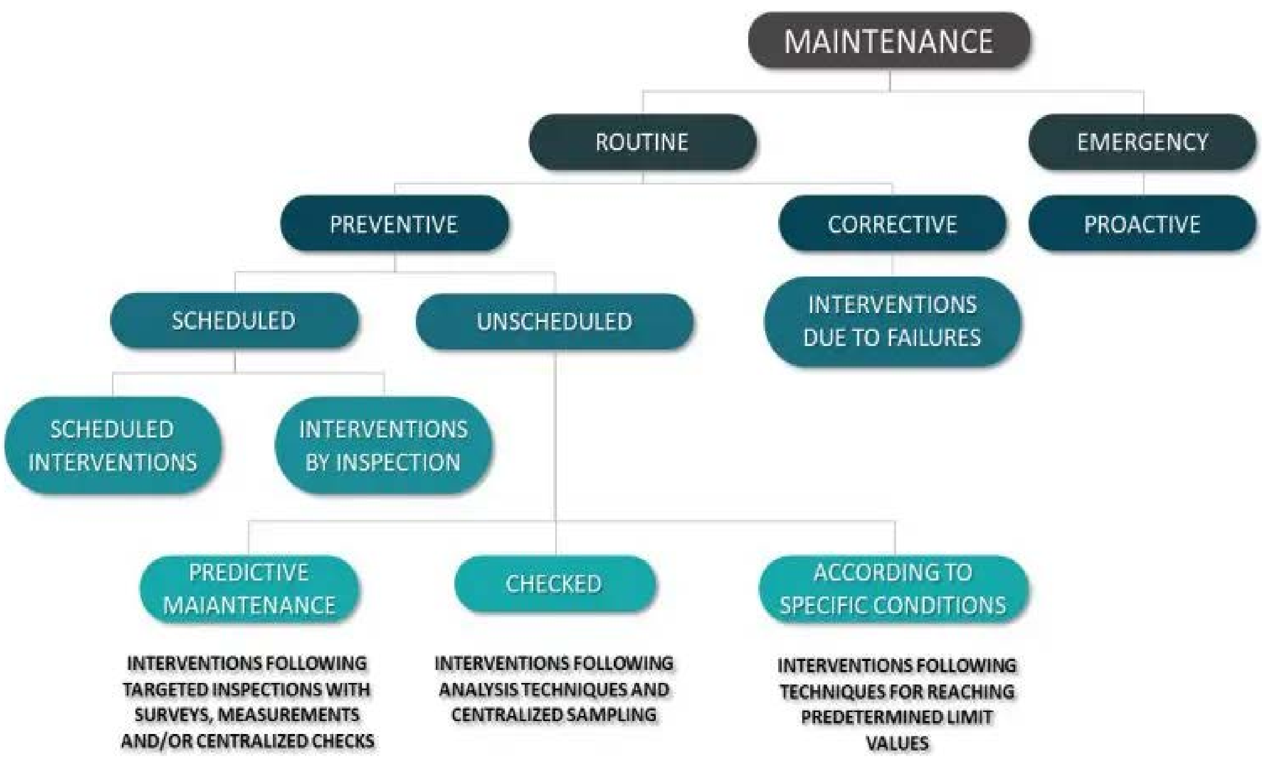
- What preventive maintenance is profitable to do?

- What are the economically profitable ways to minimize maintenance failure costs of curative maintenance:

This definition of the equipment maintenance policy could be compared to writing a musical score whose range of notes would go:

- Improvised curative maintenance: we wait for the breakdown and see what we can do to get out of it,
- Systematic preventive maintenance: we systematically change the subassemblies considered fragile, going through all the intermediate stages

III.4.3 Curative maintenance: The intervention takes place in this case at the moment when the breakdown occurs with all the disadvantages mentioned above to avoid them we put in place either a large number of spare parts or alternative equipment which can replace the machines whose shutdown conditions production. In all systems it is obvious that we can never completely avoid repair interventions but a good operations management system will put in place a preventive maintenance system in order to keep unforeseen breakdowns to a minimum.



III.4.4 Preventive maintenance

To be able to intervene preventively, it is necessary to have an idea of when the breakdown could occur. Statistical studies of component reliability sometimes allow equipment suppliers to provide very useful information in this area, such as the MTBF of components and overall [21]

According to the type of equipment (mechanical, electrical, electronic, IT, etc.). The time distribution curve between two failures is different

- When it is centered on a value and the standard deviation is small, preventive maintenance operations can be planned
- In easier cases the probability of breakdowns is correlated to one or more indicators for example. Oil analysis is especially of the particular metal present in the lubricating oils of certain mechanisms, allowing maintenance to be informed about the state of the friction surfaces and the benefit of an intervention.
- In this case we can predict breakdowns. We therefore have the possibility of preventive intervention. Or with a frequency calculated according to MTBF. Either when the indicators reach the limited values

Defining the maintenance policy for equipment requires structured thinking which requires the time of a maintenance methods technician. This time represents a cost which must be profitable due to the savings it generates [18].

A preventive maintenance program is a set of maintenance practices that help an organization in keeping assets optimized. Moreover, it assists in increasing asset performance. Effective preventive maintenance keeps track of asset performance and keeps records of service of pieces of equipment as well.

In the preventive maintenance program, all maintenance tasks are defined, and which activity needs to be done by which maintenance employees are also defined. Overall, the objective of the maintenance management program is to enhance asset performance and increase asset life so that productivity can be increased. With an effective preventive maintenance program, asset downtime will decrease up-time will be optimized, and unplanned maintenance can be avoided. Tips for preventive maintenance programs are discussed below:

III.4.4.1 Prioritizing Assets: Prioritizing assets is one of the most important tips for running an effective preventive maintenance program. That makes the maintenance team more productive as they know which assets need to be maintained first. If high-priority assets are not provided maintenance, then production work or other operations might delay.

III.4.4.2 Frequently Check Assets: Assets must be inspected and checked regularly so that you can find assets that need maintenance. When employees keep assets utilized regularly then they can find assets that are not working to their expected level. When asset performance decreases it means that assets need to be scheduled for maintenance.

III.4.4.3. Ensure All Important Assets Are Tagged

Keeping each asset tagged is especially important for the organization so that they can get all the information about that asset. When assets are tagged you can keep assets safe from theft or misplacement. Moreover, it will provide maintenance information as well.

III.4.4.4 Keep Inventory Tracked for Maintenance

Lots of times it has been seen that while performing maintenance the required spare part is not available in stock. As a result, maintenance work was delayed.

That is why it is important to keep track of inventory for maintenance otherwise the maintenance team will have to repeat the entire process again.

III.4.4.5 Avoid Over Maintenance

When an organization does more maintenance than required then assets are not able to give maximum performance. It leads to wastage of resources and complete asset utilization is not done. That is why it is important to avoid over-maintenance assets.

III.4.4.6 Create a Maintenance Activity Checklist

When you create a maintenance activity checklist then it becomes quite simple and easy for the maintenance team to work on assets.

Preventive maintenance checklist really helps the maintenance team when they have lots of assets for maintenance. It saves time and empowers the maintenance team to deliver effective work on time.

III.4.4.7 Monitor Development

Organization said their goals and objective for one year, two-year, three-year. However, it is important to keep track of development from time to time.

An improvement that has been made so far can be tracked with the date assistance and that information must be shared with the employees of the organization.

III.4.4.8 Invest in Automated Software

One of the most important tips is to invest in automated software which can assist you in all aspects. When you move your work from a traditional method to an automated method your work efficiency will increase. Automated software such as CMMS can be beneficial as this software specializes in maintenance and with all the tips mentioned above you can easily implement them with this software.

III.4.5 Reduction in breakdowns

These are only breakdowns linked to wear and tear of equipment components. Failures whose origins are a manufacturing defect, a design defect or an error in the use of equipment are not affected by this reflection action.

The reduction in breakdowns, in quantity and repair time, linked to the wear of components leads to savings in time for troubleshooting labor and above all savings in spare parts whose lifespan will not be shortened, cost of maintenance failure (CDM) generated by equipment malfunctions, cost of maintenance storage (CSM), to the extent where the wear of the components being monitored in preventive maintenance, the need to store these components as safety parts no longer has any reason to exist.

III.4.6 Reduction in repairs

The fact of planning changes of assemblies and/or sub-assemblies in good time, taking into account the monitoring of their wear, thus avoids cascading destruction of other constituents.

Example: Changing the brake pads at the right time will avoid also changing the discs in a car.

III.5 PRACTICAL APPROACH FOR CHOOSING THE MAINTENANCE POLICY FOR EQUIPMENT

The general overview of the different stages for choosing the technical and economic maintenance policy for equipment is presented in eleven stages.

- Identify the conditions of use of the equipment
- Define legal maintenance operations
- Develop lubrication plans
- Define preventive maintenance operations
- Define spare parts to stock
- Define curative maintenance aids
- Structuring implementation documents
- Estimate the cost of the maintenance policy choice made
- Demonstrate the profitability of the maintenance policy choice made
- Sell the maintenance policy choice made
- Measure the results obtained and update the choice if necessary

III.5.1 Identify the conditions of use of the equipment

The purpose of equipment in a production site is to ensure production in quantity and quality, as received when it is put into service, and this during an expected lifespan defined during the investment.

The objective of the maintenance function of this equipment is to ensure that the equipment provides minimal overall maintenance costs.

- Production features received,
- Quantities and quality of production received,
- Availability necessary for production programs,
- The expected lifespan,
- Safety conditions necessary for personnel,
- Environmental protection imposed by the legislator.

III.5.2 Define legal maintenance operations:

In order to minimize the risks of personnel accidents and protection of the environment, the legislator has specified by various orders and decrees the regulatory checks to be carried out on certain equipment. A register of regulatory checks must be kept in the maintenance department.

III.5.3 Develop lubrication plans

Equipment design choices result in lubrication constraints. Lubrication is a “mandatory” preventive maintenance operation due to the construction of equipment. Under no circumstances can it be removed, except by modifying the design of the equipment, without being certain of the occurrence of failures, or even the complete destruction of a sub-assembly or assembly of the equipment. However, in this area, maintenance policy considerations must bring progress on the quantity of points to be greased, frequency of passage, variety of oils and fats to be stored;

III.5.4 Define preventive maintenance operations

It is in this stage that the maintenance methods technician will bring all his professional knowledge and skills, as well as his spirit of profitable creativity, since it will be a question of defining what must be monitored preventively because there are risks, Periodicity of monitoring to be carried out.

The points to monitor are those which correspond to Wear of parts by friction, corrosion and/or erosion, A part whose lifespan, by construction, is less than that of the material, for example the battery of a programmable controller has a lifespan shorter than that of the automaton.

Determining the points to monitor consists of identifying these points. It can be done from six origins

1. FMEA analysis Analysis of failure modes, their effects and their criticality.
2. The experience of maintenance professionals.
3. The experience of other users of the same equipment.
4. Auscultation techniques in predictive or conditional maintenance.
5. Technical manufacturing documentation.
6. Failure analyses.

III.5.5 Define the spare parts to be stored

These are spare parts that we will call “safety spare parts”, not to be confused with the concept of safety stock used in inventory management. These safety parts are placed in stock in order to allow a troubleshooting intervention by standard exchange of the faulty part, subassembly or assembly and thus minimize as much as possible the duration of malfunction of the equipment, therefore its CDM (Cost of failure material) [6].

III.5. 6 Structure implementation documents

In this step, it is a question of formatting all the information necessary for the “user owner” of the equipment so that he can understand, participate and validate the choice of maintenance policy proposed to him, to the professionals of maintenance interventions and driving operators so that they can correctly carry out the selected operations.

- The implementation documents are the lubrication diagrams and plans, the permanent preventive instructions carried out either by the driving operators or by the maintenance professionals, the preventive work ranges, the list of spare parts to be stored, assistance with fault diagnosis, troubleshooting ranges.
- Preventive maintenance operations are divided into permanent instructions and ranges, depending on their frequency of application, in order to avoid setting up an overly cumbersome system for triggering operations at low frequency.

The standing instructions group together all interventions with a frequency of less than or equal to one month. They are triggered and followed directly by the intervention teams who are responsible for them, maintenance team or pipeline operators. The ranges are established by frequency of application. They bring together all the operations to be carried out at the same frequency. The design of a range of preventative products follows the same rules as those of a maintenance intervention preparation, with however the following particularities:

- the range is defined without taking into account the staff who will be available because it is not possible to know this when establishing the range; the operations are initiated in such a way:
- That the equipment downtime be as short as possible taking into account the intervention constraints. This search for minimum downtime makes it possible to demonstrate the concern of the maintenance methods technician to adapt maintenance to production constraints, that safety constraints are taken into account.
- The constraints of accessibility and space to intervene should not be ignored. Using two people to go twice as fast when there is no room is useless

- Control operations in progress must be carried out before locking out the equipment in order to allow any additional work which is the consequence of the observations of the controls carried out to be carried out, while the equipment is shut down. This is particularly important for predictive maintenance measures (oil analysis, vibration measurement, thermography, etc.) and will avoid requiring a new shutdown of the equipment from the “user owner” of the equipment.

III.5.7 Estimate the cost of choosing a maintenance policy

When establishing each document produced in the previous step “Structuring the implementation documents”, the intervention labor cost, the cost of the spare parts used and the storage cost of the safety spare parts. It is now about:

- ✓ Consolidate the entire overall cost of preventive maintenance which is equal to CIM + CDM + CSM = CGM preventive maintenance,
- ✓ Analyze expensive operations to check their validity, especially for the periodicity aspect.

III.5. 8 Demonstrate the profitability of the maintenance policy choice made

In this stage, it is a question of demonstrating: that the preventive maintenance operations planned are indeed necessary and sufficient, the profitability of the proposed preventive CGM compared to other possible choices.

It is quite obvious that this cannot be demonstrated mathematically because: Either the site does not have structured maintenance histories for the equipment (in the case of new equipment or in the case of a site with oral maintenance tradition), Or the site has structured maintenance histories but it is still necessary that the future conditions of use of the equipment remain relatively stable compared to the past in order to be able to extrapolate the historical values. It will therefore be a question of highlighting that the choice made obeys the rules of common sense maintenance, the CGM preventive maintenance represents a normal "insurance" cost in relation to the potential risks [16].

III.5.9 Sell the maintenance policy choice made

The implementation of the choice of maintenance policy made requires two essential conditions

- The user who owns the material agrees to its content,
- Maintenance intervention professionals consider that what has been defined is realistic and effective.

III.5.10 Measure the results obtained and update if necessary

After having made the choice that seems the most economically judicious and having "sold" it to the partners concerned, we must take reality into account provided that it can become generalized in the future, which deserves to be demonstrated. This reality is based on two sources of information

Preventive maintenance visit reports: The visit reports essentially make it possible to adapt the planned intervals. Thus, if no anomaly is observed, during three consecutive preventive maintenance visits, the frequency of these visits can be increased from 25% to 30% without major risk. Analyzes of observed malfunctions: Analyzes of malfunctions may result.

III.6 CODIFICATION SYSTEMS

It is therefore recommended to use the simplest and most flexible coding possible to avoid errors, facilitate communication and thereby speed up processing. The coding must above all be simple and easy to remember for users on the floor. As machine numbers are used for various purposes (intervention report, etc.), it is necessary to minimize transcription errors and promote coding that is easy to remember and means something as much as possible. We sometimes overestimate people's memory capacity by overusing incompatible coding or by accumulating information, without taking into account the fact that human memory is extremely limited in certain respects (short-term memory).

Consequently, a coding with three alphanumeric symbols (3 digits) will be ideal in most cases. For example, all engines can be classified as the 200 series, presses as the 300 series, forklifts as the 600 series, etc., regardless of their location. By operating in this way, however, it is necessary to ensure that the maintenance file includes the location of the equipment. It is the ideal coding system for those who want to make a computerized maintenance program.

In addition, the choice of a three-digit coding ensures compatibility with accounting systems. These generally allow three-digit auxiliary numbers to be entered. We can then use these auxiliary numbers to distribute the costs related to maintenance for each coded piece of equipment and thus obtain a cumulative cost report at any time for each piece of equipment.

III.6.1 Imputation code

This is a way of simplifying the subsequent exploitation of the history by the methods agent. The cause, nature or location are coded by a letter or a number as mentioned in Figure bellow [21].

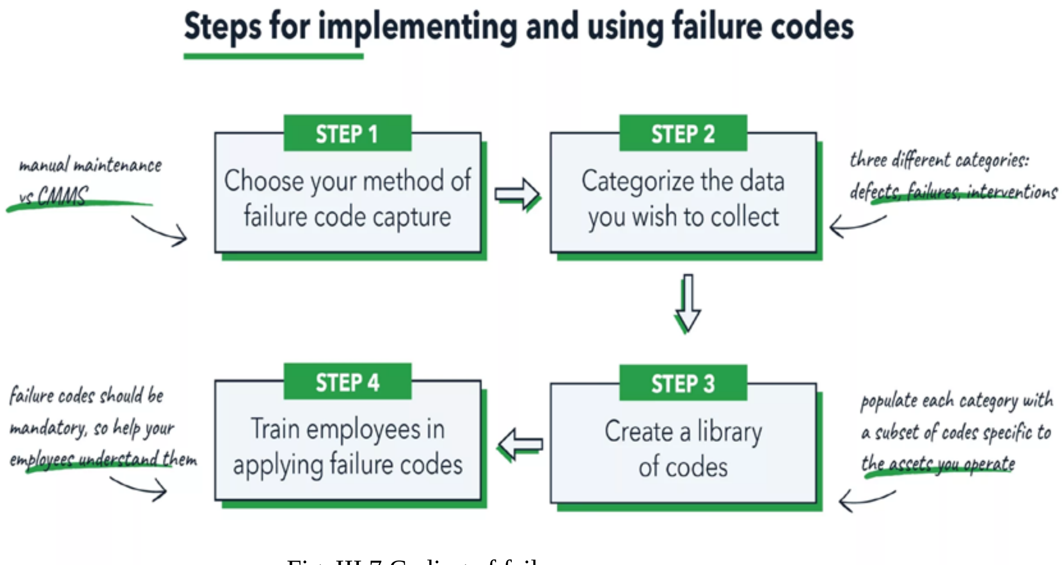


Fig. III.7 Coding of failure causes

Code	Nature of failure	Code	Nature of failure
0	mechanic	*3*	Pneumatic
1	Electric	*4*	human
2	hydraulic	*5*	Other

Table III.1 Coding of types of failure

Code	Location of failure	Code	Location of failure
0	Order part	*3*	Engine
1	Automaton	*4*	Transfer
2	Sensor	*5*	Other

Table III.2 Coding of locations

III.6.2 Inventory and codification:

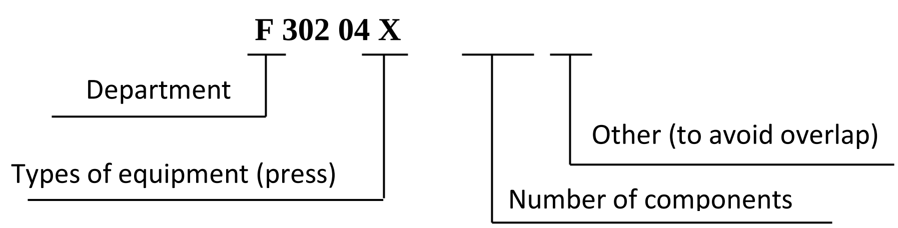
It is important to take a physical inventory of all existing equipment in the company. This step must be done by maintenance personnel because they must know the equipment and how it works so as not to omit important components in the inventory (example: motors, generator pumps, etc.). Each of the equipment inventoried will subsequently be codified to allow the management of maintenance files (technical sheet, history sheet, preventive maintenance sheet). [17]

III.6.2.1. Inventory the equipment:

This coding becomes in a way the main identification of the equipment as long as it is in the factory and this code will remain the common denominator for all departments of the company to refer to it (accounting, production, maintenance, ...).

It is important to take a physical inventory of all existing equipment in the company. This step must be done by maintenance personnel because they must know the equipment and its operation well so as not to neglect important components in the inventory (example: motors, generator pumps, etc.). Each of the equipment inventoried will subsequently be codified to allow the management of maintenance files (technical sheet, history sheet, preventive maintenance sheet).

Example: Codification F 3 02 – 04



The number F302-04 identifies engine #04 of press #302 in manufacturing department F. This type of coding is often used but is not the most flexible. For example, if the motor from press #302 is used on another press in another department, its coding would have to be changed; which implies a modification of the maintenance file (the addition of reference X).

It is therefore recommended to use the simplest and most flexible coding possible to avoid errors, facilitate communication and thereby speed up processing. The coding must above all be simple and easy to remember for users on the floor.

III.6.2.2 Coding of equipment and components

The coding is a nomenclature making it possible to identify the inventory of the fleet to be maintained. Generally, it is established following a tree family logic. It allows the technical and economic management of the service through the possibility of allocating failures and costs to sectors, types of machines, etc.

It is interesting to use an internal alphanumeric code for maintenance, which will characterize each level of the inventory breakdown by numbers or letters. We will group equipment with similar functions under the same code. For example, it is interesting to be able to call under the same code the 1500 centrifugal pumps scattered across the 3 production lines of a paper mill. We must distinguish between “ideological” coding for manual processing and “blind” coding for computer processing. [18]

AFNOR proposes the following structure, which must obviously be adapted to the context. Together ? Service? Location ? Type (family)? Machines? Functional group? Module

Together	Service	Type	Machine	Functional group	Module	Piece
Factory A	Layout	Press Tour	P1 P2	Mechanical Control	Power Automation	Piston

III.7 CONCLUSION

Planning and structuring the maintenance department are founding functions of the maintenance department, because if we do not know how to plan and structure our maintenance department, we will not be able to achieve our objective which is the maintenance of assets. The main mission of the maintenance function is to maintain the availability of the production tool through preventive and corrective actions; that is to say, its ability to accomplisha required function, under given conditions of use, for a given period.

Optimal management of an industrial installation throughout its lifespan, from design to dismantling, requires the search for a compromise between often conflicting objectives. We distinguish on the one hand the economic performances: costs and benefits, and on the other hand the aspects of reliability, availability, personal safety and safety of the installations. To provide decision-making support for this problem, it is necessary to have tools and methods to analyze industrial installations and quantitatively evaluate their performance in terms of maintenance, while respecting economic constraints. Codification is very important in the field of data management. maintenance documentation because it facilitates knowledge and communication between method office agents and those involved and saves intervention time as it allows you to know the installations, equipment and precisely locate the location of the maintenance 'intervention.