

The Importance of Equipment Maintenance Forecasting

Jigar K Patel

M.B.A (Systems & Marketing), Houston, Texas, USA

Received Date: 24 April 2021

Revised Date: 29 May 2021

Accepted Date: 31 May 2021

Abstract — *The purpose of equipment maintenance in any industries is simple: to minimize costly equipment failures and ensure that equipment operates at its top capacity. Yet there is still a fraction of the production world that views equipment maintenance as an unnecessary consumption of manufacturing hours and unnecessary cost to the equipment life cycle. With costs being so immoderate, why would a manufacturing or production facility risk unexpected downtime due to lack of equipment maintenance? The answer is, of course, time and lack of maintenance forecast. In a manufacturing facility, they are always focus on to get the job done as quickly as possible to save labor hour cost. If customer orders are there, it seems the only answer is to produce the components to fill them as quickly as possible. But that isn't always the best approach.*

Keywords — *Down time, Equipment failure, Equipment maintenance cost, Preventive maintenance, Maintenance forecast*

I. INTRODUCTION

The goal behind appropriate maintenance forecasting is to always ensure that the equipment in a facility is running at 100% operational capacity. This standard upholds the highest production standard, and it also reduces equipment maintenance costs drastically. With the latest age of technology, cloud computing, the Internet of Things, and smart sensors have further improved equipment maintenance standards. Now, a regular visit by equipment technicians is not required because modern-day technology can do that for you.

For instance, smart sensors can notify plant managers of potential threats that can come up in real-time so they can tend to those threats before the problem arises and the production process gets interrupted. Moreover, when a workflow incorporates daily, weekly or monthly inspections, small maintenance recovery tasks like lubricating, cleaning and small adjustments can prevent massive problems from developing. Managers often build simple processes into their operational procedures to ensure equipment is always performing at the highest level.

For instance, they set up different processes to analyze the performance of the data from their systems, which also helps them monitor operations. This lets them become aware of

potential problems before they become big threats.

Moreover, they can also provide appropriate training to operators and technicians. This means, when a problem is detected, they can recognize these issues and then deal with them appropriately. Additionally, their expertise and training can prevent the problems of overuse and misuse, which can cause unnecessary repairs.

A. Budget

Spending on maintenance and repairs is a normal and expected cost of a production facility. However, even though equipment maintenance costs can come up often, they can be reduced with the help of a rigorous facility management program and using the appropriate tools for diagnostics. This is the key to success for managers since this approach lets them have realistic expectations and become proactive with the help of a long term equipment maintenance program. Well-planned equipment maintenance program is cost-effective and it also helps you budget efficiently.

When you lack a proper equipment maintenance program, you often find yourself taking part in crisis management repairs. Business breakdown becomes a normal occurrence and a reactionary approach like this causes high penalty costs. Not only is this approach expensive, but it requires additional maintenance and repairs.

Consequently, when companies indulge in increased emergency repairs, facilities and components tend to fail quickly because of high levels of deterioration. On most occasions, the repair and inspection process relies heavily on the observation and experience skills of the person inspecting it. That said, several deficiencies in a facility can be ignored in an inspection until they become extremely hard to deal with.

Fortunately, in a situation like this, diagnostic tools can help management and the experienced inspectors of equipment. Surveys in the production facility are developed to create long-range work completion plans and for budgeting reasons. Since these surveys don't have to be thorough, several diagnostic tools can provide useful data in a cost-effective manner.

B. Capacity Planning

A capacity planning strategy for equipment maintenance incorporates every element of the production facility such as



budgets, personnel, facilities, supplies, and production schedules. This can help manufacturers carefully monitor each and every production cost, especially during times of recession and growth.

When a manufacturer is able to predict the needs of an equipment maintenance, they can accurately plan and budget for the upcoming changes and then apply those financial resources wherever needed. This also helps them develop relevant schedules for delivery for their supplies and the shipping schedules for these products.

With enough capacity planning, managers can identify the appropriate skills that are required to deliver on these key projects and plan for the shortages that can come up in the future. Managers can then work accordingly and forecast whether they need to make decisions regarding the in-house skills vs. outsourced skills. Capacity planning also ensures that an employee's training needs are always met and that they can decide how projects are going to be delivered in the future.

C. Maintenance and Cost Control

Not only does a planned maintenance contract meet the ever-changing demands and dimensions of the heavy equipment industry, but it also makes sense from a tracking and budgeting standpoint to have complete control over the cost of ownership.

The combination of planned maintenance and extended warranty can help reduce the operating costs while simultaneously increasing the return on investment. Simply put, having a planned maintenance routine also takes the uncertainty out of the maintenance cost. This helps companies achieve a lower cost of ownership, which ultimately gives you a higher resale value for the equipment you use.

A planned maintenance schedule can also help you budget for the ongoing maintenance such as travel, lubricants, parts, supplies, and labor, after which it can provide the totals per month and the length of the contract. Knowing the fixed costs of these planned maintenance schedules can also help you minimize the effect of unplanned business expenditures. This saves you from the minimal repairs that come up often and deplete your budget for maintenance.

Buying a equipment with a smaller price tag can end up costing more in the long run because of the constant repairs you need to get done. In comparison, a higher quality equipment can be a lot more profitable in the long run since they're reliable and require lesser repairs. It's worth noting that it doesn't make sense to spend more on the repairs of a equipment than the price of the equipment itself. For instance, instead of getting an expensive engine repaired, use that money to get a completely new one that is more efficient and will last you longer.

D. Reducing Down Times

The modern world is driven by the wonders of data. Manufacturers tend to look for low-cost sensors that can detect and prevent downtimes on the floor of the factory. These sensors can detect different inputs like vibration, heat, light, and temperature, which are all great indicators of knowing when a piece of equipment has failed or become damaged. Then these sensors send this data back to the central point, which alerts production managers. They can then tell whether anything has gone wrong, upon which they take corrective measures to save equipment from further damage, which thereby reduces the overall downtime.

These Sensors are affordable and can be added to possibly any equipment and are approximately the size of a mouse that you use with your computer, which is why they are well worth the initial investment you make on them. Moreover, take some time out and ask yourself, who affects your downtime the most? Is it your maintenance technicians, line operators, or production supervisors? Staff members that have the highest potential to prolong these downtime events are often your biggest liabilities. Secondly, the operator is often the second most common cause of downtime after a hardware error occurs. A good operator not only diagnoses and fixes their own equipment but also have the ability to prevent future downtime events with the help of accurate documentation and prompt maintenance schedules.

A planned equipment maintenance program also maintain the cost of ownership by protecting the production facility from downtime and immediate costly repairs. That said, the ability to minimize the downtimes depends completely on how proactive one is about taking care of their equipment or asset. A proactively planned maintenance schedule by a seasoned technician addresses the minor fixes before it's time to make major repairs. Identifying these issues for repair during regular maintenance helps avoid breakdowns and unscheduled downtimes. A reliable maintenance interval can also make it possible for you to easily schedule equipment service at a given time and location that doesn't hinder productivity.

Additionally, some manufacturers also have road service technicians and trucks that can travel to a jobsite and complete the routine maintenance and run necessary diagnostics if a equipment begins to experience any problems. Not only does this get your equipment functional again, but it also gets it to run more quickly while eliminating the cost and time you would've taken to bring in another piece of equipment to make the repairs.

E. Avoid Emergency Corrective Action

There are no two opinions about this: equipment doesn't last forever but if you follow a consistent maintenance schedule, you can increase the life of your equipment greatly. Regular maintenance reduces the chances of

downtime and failure, which increases the overall effectiveness, improves productivity and increases safety too.

Research has repeatedly shown that 78% of all manufacturing facilities follow a preventive maintenance strategy while 59% used a computerized system for management.

However, even after such practices, facilities run into failure and then use a “run-to-failure” method of dealing with problems. While these operators would prefer saving on maintenance and get additional run time, this approach lets their equipment run for longer periods of times with far fewer downtime incidents.

Plus, it also gives operators opportunities for overall improvements of efficiency. The best way your equipment maintenance team can prevent cases of emergency maintenance is by ensuring that a schedule for maintenance exists. The different kinds of maintenance schedules can be:

- Prescriptive maintenance
- Predictive maintenance
- Condition-based maintenance
- Preventive maintenance

These planned strategies can easily identify issues and then put in place the necessary processes to repair a production facility’s valuable assets before failure occurs. To ensure these maintenance strategies remain effective, a facility’s maintenance upkeep program must have the necessary training to ensure every worker understands the difference between emergency and urgent maintenance.

If an asset fails to operate, is there another reasonable option? If so, maintenance can be scheduled on an emergency basis.

F. Increase Equipment Life

The life cycle of equipment is affected by a number of factors, but regular maintenance has proven to extend the life of a equipment fourfold. Operating a equipment that is highly productive for extended periods of time offers a high return on your investment, and in turn, you can enjoy the lowest cost of ownership.

Some equipment require maintenance intervals a lot more frequently, like those that are operating in a dusty environment. An experienced maintenance calculator is going to let a dealer make the necessary adjustments that make up preventive techniques like frequently changing the engine oil and waiting for filter change intervals.

Moreover, when your equipment is running frequently, not only you are able to complete your projects on time, but you can also get a good resale price from the sale of your equipment. And while you may have no control over the supply and demand of your equipment or the market, you can influence the value of your equipment with a planned

maintenance schedule.

With a planned maintenance contract, the additional benefit is a well-documented history of service and care done completely on your equipment. When potential buyers get to know about this, they are more willing to pay a higher price and invest a significant amount to take the equipment off your hands.

Being proactive about maintenance benefits your business and you in the long run. A planned maintenance contract provides you with the necessary highly skilled services that can add value to your business. This, in turn, reduces downtime & costs and increases productivity, which improves your investment and the business’s bottom line altogether.

G. Compliance With Regulations

Providing a maintenance technician with a safe work environment can be an extremely challenging task. The nature of the job requires the technician to put him or herself in different situations every day. This adds additional risk that might not be present in other professions. So how do we keep these employees safe?

Establishing a healthy and safe work environment can significantly reduce the number of illnesses and workplace injuries. A comprehensive program includes management support, hazard identification, worker co-operation, hazard prevention, and education and training. All of these elements are key to maintaining a healthful and safe working environment. But to ensure that things fall into place easily, it is imperative a production facility takes the following essential steps:

Employee Involvement and Management Commitment

You can have all of the fancy programs you want, but until you get the commitment from top management and get the employees fully engaged, you likely will not have a safe working environment.

A production facility must clearly define specific and clear workplace policies that facilitate a clear understanding for onsite personnel, which provides the top-level leadership with a healthy chance for involvement when a program is being implemented.

Prevention and Hazard Control

It’s also important to establish work practices and policies early that ensure compliance and understanding are at the highest levels. These added levels of training help examine the responsibilities of both management and employees, which also promotes compliance and accountability. Moreover, educational programs can also be designed to ensure awareness and understanding of the proper methods of avoiding hazards.

Training

Employee safety training: It’s one of those things we recognize as critical, but what makes an employee safety

training program effective? Start by covering these key workplace safety topics that are applicable to almost every industry.

1. Workplace ergonomics
2. Fire safety program
3. Workplace violence prevention program
4. Employee health resources
5. Environmental safety
6. Equipment safety
7. Online safety and cyber security

Each of these employee safety training topics are an important part of your company-wide commitment to keeping your employees and customers safe. While these safety topics may not cover all the areas you need training for, they're a great start.

H. Manufacturing Warranty Requirements

When a production facility acquires a new asset like a equipment, it comes with a warranty that can be availed when a feature or an option in the equipment stops working. However, every equipment comes with a certain requirement that has to be fulfilled to avail of the warranty. For a manufacturing business, equipment is often critical. When an organization's equipments fail, the processes involved and different businesses slowly start to face hurdles. Even though a equipment's warranty won't necessarily stop the failures from happening, they do offer insurance for a potential breakdown.

This means that a warranty can save a business thousands in replacement or repair costs, which can help your business get off the ground and up and running in no time. Think about these warranties as a guarantee. A warranty states that if you follow the necessary maintenance and usage techniques, your equipment is going to be functional for a specific period. The most common warranty length can be a year, 3 years, or 5 years. In fact, a manufacturing warranty like such is an absolute necessity. Every piece of equipment has moving parts, mechanical systems, and complex motors that can be prone to wear and tear. This can especially be true when a equipment is used regularly. A warranty can ensure that the costs of these parts and your labor are covered if something goes wrong.

But apart from the peace of mind you get from knowing that your equipment is always protected, a warranty offers several key benefits. These can be:

- Proving coverage for important components: Most of the pieces involved in manufacturing different things have complex elements. A warranty can protect these critical components from getting damaged.
- Labor and part included: A warranty typically covers labor and the parts for a piece of equipment. This means that you send the equipment for repair and no cost is passed on to your business for this.

- Saving yourself from faulty equipment: Investing in a manufacturing unit is a significant investment for any business. A business needs the protection that the warranty comes with to avoid faulty products.

I. Equipment Health

If implemented properly, a preventative or preventive maintenance plan can result in increased savings over an extended period as your assets tend to last for longer. This also means that your assets use lesser energy and create fewer interruptions in the overall process.

If these measures are properly implemented, they can create several advantages for a production facility or a company in the long run. One of the largest benefits that preventive measures can add is that they make your systems reliable and production lines continue without being interrupted. Regular preventive maintenance as per schedule will help to avoid costly unnecessary corrective maintenance that can lead to major down times.

There are lots of reasons to enact a serious preventive maintenance regimen and schedule. For example, it:

- Keeps equipment running at it's top performance levels
- Minimizes fuel consumption
- Maximizes efficiency and uptime
- Catches problems early, resulting in faster, easier, cheaper repairs and replacements cost
- Prevents small issues with components from affecting entire systems to avoid costly down time
- Extends the life of heavy equipment significantly, reducing replacement costs

J. Reporting

If you are using any Enterprise resource planning software, make sure you have tools or reports to forecast equipment maintenance schedule for next five years well in advance to plan internal labor, external labor and materials requirement to do equipment maintenance in future. Use maintenance planning forecast report to minimize equipment downtime by ensuring that the necessary materials, internal labor and external labor are available when a piece of equipment requires a maintenance.

When you use maintenance planning forecast report, you define a range of maintenance work orders for which the system projects parts requirements and labor requirements. You can integrate this information with forecasted (planned) work orders that the system generates when you run a preventive maintenance forecast report.

After the system generates a preventive maintenance forecast schedule, you can:

- Review information from the preventive

maintenance planned schedule

- Review a required parts plan.
- Respond to system recommendations for purchasing materials
- Review a required internal and external labor plan.
- Revise a labor plan to accommodate available resources.
- Review the maintenance plan within the resource assignments crew scheduling processes.

K. Combined Maintenance Work

If at all possible, combine corrective repair with scheduled maintenance for a given piece of equipment. For example, if a production line will be down because of oil change needs to be done, visual inspection and filter replacement should be scheduled for the same window of downtime if feasible. This makes full use of downtime, and ensures that production isn't interrupted multiple times because of same equipment.

By scheduling repair work ahead of time, facilities can group minor maintenance tasks that are due within the same time frame into the repair schedule, instead of causing small yet costly episodes of downtime. Scheduled repair work also allows for parts to be ordered and received, and labor hours planned, avoiding the need for costly overtime.

II. Conclusion

Maintenance is one of the largest costs for ongoing fleets. It's a huge part of a fleet's total cost of ownership, and while some supervisors can have a hard determining the total cost, equipment management software can do that for you. This way, you can make actionable changes to improve the operations of your fleet holistically. Collecting information for a equipment downtime, the cost of replacement for parts, the average time between failures and response time, is a technician's responsibility. Companies can either opt for a computerized or manual system when it's about picking equipment maintenance

software. While software may seem costly, it's going to need an upfront investment, which is on a subscription fee model. But then again, it does come with several benefits.

REFERENCES

- [1] Alfares HK Aircraft maintenance workforce scheduling: a case study. *J of Qual in Maint Eng* 5 (1999) 78–88.
- [2] Alfares HK A simulation approach for stochastic employee days-off scheduling. *Int J of Model and Simul* 27 (2007) 9–15.
- [3] Banks J, Carson JS II, Nelson BL, Nicol DM *Discrete-Event Simulation*, 4th Edition, Prentice Hall, Upper Saddle River, USA. (2005).
- [4] Box GP, Jenkins GM *Time Series Analysis, Forecasting and Control*, Holden-Day, San Francisco, USA. (1970).
- [5] Duffuaa SO *Mathematical Models in Maintenance planning and scheduling*, in Ben-Daya M, Duffuaa SO, Raouf A (eds.), *Maintenance Modeling and Optimization*, Kluwer, Boston, USA, (2000) 39–53.
- [6] Duffuaa SO, Al-Sultan KS A stochastic programming model for scheduling maintenance personnel. *Appl Math Model* 23 (1999) 385–397
- [7] Duffuaa SO, Ben-Daya M, Al-Sultan KS, Andijani AA, A generic conceptual simulation model for maintenance systems. *J of Qual in Maint Eng* 7 (2001) 207–219
- [8] Duffuaa SO, Raouf A, Campbell JD, *Planning and Control of Maintenance Systems: Modeling and Analysis*, John Wiley & Sons, New York, USA. (1999).
- [9] Kelly AD *Managing Maintenance Resources*, Elsevier. (2006).
- [10] Kelly AD ., *The Maintenance Management Framework*, Springer, London, (2007) 157–184.
- [11] Nahmias S., *Production and Operations Analysis*, 5th Edition, McGraw-Hill, Singapore. (2005).
- [12] Rowe, G and Wright, G, *Expert Opinions in Forecasting. Role of the Delphi Technique*. In Armstrong (Ed.), *Principles of Forecasting: A Handbook of Researchers and Practitioners*, Kluwer, Boston, (2001) 125–144.
- [13] Sohn SY, Oh KY, Simulation study for the optimal repair capacity of an IT maintenance center based on LRD failure distribution. *Comput & Oper Res* 31 (2004) 745–759.
- [14] Taha H, *Operations Research: An Introduction*, 7th Edition, Prentice Hall, Upper Saddle River, USA. (2003).
- [15] Jigar K Patel.,ERP Implementation and Successful Post Sustainment, *International Journal of Computer Trends and Technology* 68(10)(2020) 44-48
- [16] Jigar K Patel,Critical Success Factors for Implementation of Enterprise Resource Planning Software SSRG *International Journal of Computer Science and Engineering* . 8 (2) (2021) 1-5.