ASSET STRATEGY MANAGEMENT ASMx

A LEADER'S GUIDE TO RELIABILITY TRANSFORMATION IN THE DIGITAL AGE

JASON APPS

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A Leader's Guide to Reliability Transformation in the Digital Age

Jason Apps

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For information: Reliabilityweb.com
www.reliabilityweb.com
8991 Daniels Center Drive, Suite 105, Ft. Myers, FL 33912
Toll Free: 888-575-1245 | Phone: 239-333-2500
E-mail: crm@reliabilityweb.com

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SECTION 1

A Typical Reliability Environment

We have reliability engineers, but no reliability.

In most industrial plants, the pursuit of reliability improvement has been in place in some fashion since the early to mid-1990s. The first step for most organizations was placing reliability engineers within the organizational structure.

In these early days, the term reliability was undefined in most organizations and, in many ways, this remains true. In some organizations, a reliability engineer was responsible for reliability strategy review and, in other cases, root cause analysis (RCA) or equipment condition monitoring, such as vibration and/or oil analysis.

As is often still the case, organizations talk about and even calculate what they call a reliability metric, yet it's an availability figure or, worse still, based on a unique calculation they have derived.

In almost all industrial cases, the role of a reliability engineer has the requirement to improve availability, thus probably should be called availability engineer, or perhaps better still, performance/improvement engineer.

To clear it up:

> **Reliability** is the ability to perform a required function under given conditions for a given time.
>
> **Availability** is the ability of an item to be in a state to perform a required function under given conditions at a given instant of time, or in average, over a given time interval, assuming the required external resources are available.

These two definitions represent accepted definitions from the International Organization for Standardization (ISO) and are accurate and correct. But, here is a practical adaptation to help people understand the difference:

> **Reliability** is the likelihood an item will operate for a desired period of time before failure.
>
> **Availability** is the proportion of time an item or system is available to operate.

Let's take an extreme case, assuming no other operational or process implications. Would you rather have a component that fails once a month for one minute or one that fails once a year for one month?

This is a case where the component with the poor reliability yields much greater availability and is probably the preferred option. This is, of course, provided the impacts of failure are associated with production or process downtime and are not failures that have critical event occurrences, such as an explosion, fire, or safety impacts.

Naturally, it all depends on the operations or process dependencies, but it does prove the point that you should be really clear about what you are trying to improve and what delivers the most value to the organization.

ANY GIVEN SITE

At almost all industrial sites nowadays, some form of reliability engineer is in place. It is commonplace to call them analysis and improvement engineers, improvement engineers, or some similar play on the term. Fundamentally, however, there is a resource or team with the accountability for asset reliability and availability.

With the creation of the reliability function within organizations in the early days, it was typical, and in many cases remains true, for either smart, young engineers or experienced trades-based personnel to fill these roles. There was not, and still no, undergraduate degree in reliability engineering.

Some argue the reliability discipline warrants its own undergraduate degree, while others argue that reliability engineers can be from another engineering discipline and trained within the reliability function. This book promotes the stance that a reliability undergraduate degree is warranted, whereby reliability engineers would be specialists in all facets of data analysis, reliability techniques and analysis, problem-solving and business acumen. The reasoning is that the principles of reliability engineering are generic and applicable across all typical industrial engineering disciplines.

Certainly, in the recent past, there has been an explosion of available postgraduate certificates, diplomas and postgraduate degrees in reliability, all supporting the development of graduate engineers or experienced technicians in the concepts of reliability.

The history and evolution of filling reliability roles is important because it demonstrates the lack of training, support, education, process and technology to deliver the functional requirement. It was not uncommon, for example, to get moved from a mechanical engineering role to a reliability engineering role with nothing more than a title change and a new position description.

In fact, this was my first exposure to reliability engineering!

No wonder reliability, availability and performance didn't really improve in any sustainable way.

Of course, over the years, inroads have been made to the availability of education and support to reliability roles. However, the process and technology support that would drive improvement in a sustainable way is still absent.

What one typically finds on most industrial sites:

- A Reliability Team is in place:
  - They may be site-based, corporate-based, or both;
  - Usually a mix of young engineers and experienced, practical personnel.
- Limited reliability strategy review is occurring;
- Any reliability strategy development or review that is occurring is piecemeal and spread across spreadsheets or different applications;

- No or limited approval of any reliability strategy changes;
- The team has challenges with knowing what to work on and has limited resources to execute the work;
- There are similar assets on-site or within the organization with different reliability strategies and you don't know if that's justified or which strategy is best;
- There are localized areas of reliability excellence, but you can't leverage those across the asset base;
- The work execution management system and process allow reliability strategies and tactics to be changed with no review, or in other cases, the reliability strategy is locked down with a rigid, time-consuming management of change (MOC) process;
- You are not sure if what is being executed matches the agreed reliability strategy (if that is documented anywhere);
- Any reliability strategy review is executed as a project, not a process.

What this typically leads to is:

- No line of sight from work that is being executed in the field to the reliability analysis that justifies the task and the interval. Ultimately, this means when unplanned failures occur, there is no easy way to:
  - Extract the relevant, current maintenance plans from the EAM system;
  - Trace them back to the completed reliability analysis, the failure mode being addressed, or justification of the reliability strategy, including a full audit trail of the history.
- The reliability team gets bogged down in conducting root cause analysis investigations. The team probably completes a top ten analysis and attempts to work its way through the list by conducting relevant RCAs.

What's happening fundamentally is that the organization is performance-led. In other words, it is being led by the performance it is getting. There is no looking forward, only looking backward. The top ten analysis is a rear view look at the worst stuff that's happened!

The organization is responding to the performance it is getting with no, or at best, limited, view on driving the performance it wants.

It is key to understand why this has become the typical site reliability landscape. Quite simply, there is no process that supports any other way of working.

1. How often do you review reliability strategies?
2. On what assets?
3. What's the process you follow?
4. Where's the data captured?
5. Who approves any changes?
6. Who implements the outcomes?
7. How do you know whether any changes deliver the outcomes you want?
8. When do you need to review/update it again?

So, there is no defined process for reliability strategy review and update, or, even if there is, what's always missing is any kind of trigger to start the review process.

THE FOCUS

RCA investigations, on the other hand, have a natural trigger, in that an event of significance has occurred, usually quite visible to the organization, so action must be taken.

Therefore, even when the RCA investigation process is informal, with limited support and technology, the RCA still gets done because of the trigger that starts the process.

This, of course, doesn't necessarily mean the RCA is completed well. In fact, in most cases, RCA investigations do not find a set of cause and effect relationships of significance and, therefore, do not lead to effective solutions that prevent reoccurrence of the problem.

So, RCA investigations become the focal point for reliability engineers. What's fascinating to find is that in most cases, the reliability folks will report that they have a backlog of RCAs to complete. This fact alone should indicate that the strategy of just completing RCAs is ineffective or, at the very least, the RCAs being completed are ineffective.

This lack of driving performance outcomes and allowing reliability engineers to be performance led is leading to a cycle of reaction.

THE OUTCOME

There is only one outcome to these typical environments and that is underperformance. This likely will have the associated problems of high costs and unknown risk levels. Ultimately, the organization is not in control of the asset. There is no governance of the reliability strategy decision and related content.

There are two possibilities:

1. Reliability strategy related content is being changed, informally, without overview, analysis, review and approval;
2. Reliability strategy related content is not changing at all because the MOC process is so rigid.

Both possible environments, which usually depend on the industry sector, lead to undesirable outcomes.

The reliability strategy should be changing constantly for a range of reasons, such as:

- Operational context changes;
- Changes in market conditions;
- Equipment ages;
- Technology changes;
- Fixed cost changes;
- Organizational priorities change.

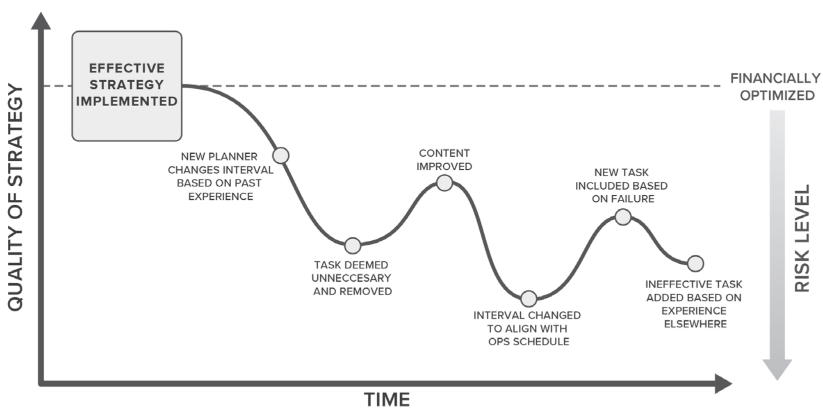

Figure 1: How risk exposure changes as reliability strategy content is updated over time

Over 80% of organizations do not have a formal compliance check in place to ensure routine tasks within their EAM system are aligned to the agreed reliability strategy

In environment one in Figure 1, the reliability strategy is changed informally. It is likely not changing at all in alignment with the changing environment. This leads to an unknown, potentially undesirable level of risk.

In environment two in Figure 2, the reliability strategy rarely changes, mainly because of the difficulty. It certainly does not keep alignment to the changing environment.

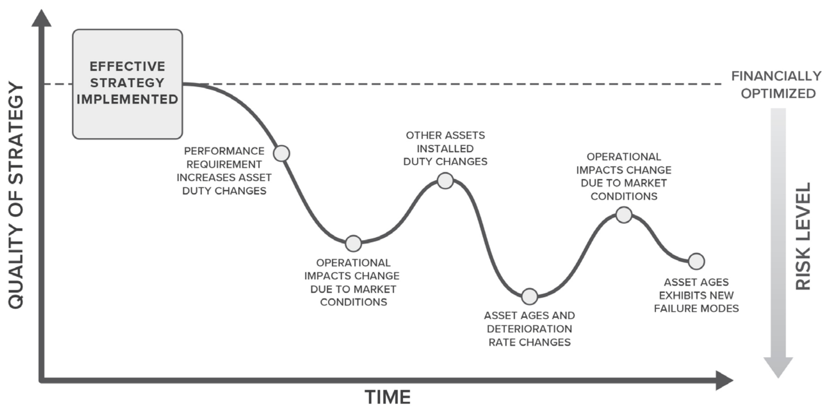

Figure 2: How risk changes over time if strategy content is fixed

So, the reliability strategy is either changing in ways it shouldn't, or not changing at all when it should.

Over 70% of organizations do not have a formal, consistent process to ensure the appropriate review of reliability strategy changes

The staggering reality is that most organizations are literally ignorant to the level of risk with which they are operating based on their existing reliability strategies. The unplanned failures still being experienced are not unforeseeable, most could and should be addressed by a reliability strategy that's dynamic and always aligned to the changing operational environment.

To illustrate this point, let's take an example scenario.

- An asset fails due to a specific failure mode, on average, once per year.
- When it fails, the asset is out of service for eight hours.
- Outages cost $1,000 per hour in lost production.
- The cost of the repair is $100 per hour for labor and $1,000 for the spare.
- The asset is currently inspected for this failure mode every week. The inspection takes fifteen minutes.
- For the sake of the math, let's say the inspection is one hundred percent accurate and any degradation detected during the inspection allows for the repair to be conducted in a planned outage where the organization won't incur the lost production costs.

In this simple environment, if the organization just lets the asset fail and repairs it, the total cost (TC) over a ten-year period is $98,000.

This is calculated by:

- 10 failures x (8 hours x $100 per hour for labor) + $1,000 spare + (8 hours x $1,000 per hour outage cost)

If recalculated with the inspection turned on, the total cost is:

TC = inspection costs + planned repair costs

> Remember that the inspection is one hundred percent effective. So, the inspection detects when the failure mode is likely to occur and plans a repair to avoid the unplanned failure.

So, TC = $31,150

This equates to about one third the cost of the run to failure scenario.

Let's assume the required analysis is done and the weekly inspection is an optimal routine task. The organization implements the reliability strategy. But, let's say no degradation is detected after six months, so it is decided (incorrectly) to extend the interval. Or, perhaps there is a change in another plan that this task can be aligned to, so the interval is extended. Or, someone comes to the organization with experience and the opinion that the interval can be extended.

There are several reasons why a reliability strategy gets changed, but the reality is the change takes place with no reliability analysis or a flawed reliability analysis.

Let's say, for example, the interval is extended to two weeks rather than one week. The TC becomes $63,600.

The inspection is no longer effective. The interval is too great for the degradation's characteristics. Some of the impeding failures are detected, but some are missed, resulting in some unplanned failures.

In practice, what is happening within plants is that people are intending to improve the performance or reduce costs, but without a sound, reliability-based review, it is very easy to make serious errors that lead to significant impacts. In the previous example, the numbers assume a fixed P-F interval (defined later in the book, but think of it as the warning or degradation time) of one week. This means inspecting at one week or less will detect the degradation and a planned repair can be completed.

If extended to two weeks, the inspections are too far apart and the degradation can happen between inspections and the failure occurs in an unplanned manner.

In reality, of course, the numbers are not so cut and dried. But what is certain, is that reliability strategies in any system have been changed, with good intent, but without due diligence. Therefore, it puts the organization at an unknown, but probably increased, level of risk of failure.

If the organization goes back to the one week inspection strategy, the TC is $31,150. To illustrate the impact of good WEM, let's say through sound work execution management principles, the efficiency of the repair activity improves.

For illustration purposes, let's say efficiency improves by twenty-five percent, meaning the duration of the repair activity takes six hours rather than eight, which could be achieved through improvements, such as reduced logistical delays associated with materials being available or ensuring the asset is ready for maintenance when the tradesperson arrives.

In this scenario, with a weekly inspection and an improvement in WEM efficiency, the TC reduces from $31,150 to $29,100.

While this is a very specific example with set parameters, the principles are universal in that reliability strategy changes will generally have a much more significant impact on performance and total costs than efficient work that is delivered by the WEM process.

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Over the past decade, the reliability and maintenance discipline has seen significant change: ever-shifting business climates, organizational structure changes, increased performance accountability, and of course, the explosion of the digital era, technology advancement and big data.

For many organizations, though, their process of managing reliability strategies has remained the same: informal at best, nonexistent at worst. Which is why most organizations, no matter what they try, continue to be plagued with poor performance, unplanned failures, high cost and significant risk.

Enter asset strategy management ASMx, a transformative framework for continuous reliability improvement. *Asset Strategy Management ASMx: A Leader's Guide to Reliability Transformation in the Digital Age* articulates the value delivered by ASM, why it's needed, what it involves and how to implement ASM to enable a culture of reliability that will translate to better business outcomes.

"I urge anyone who has a stake in asset management within their organization to digest the contents of this book."

- Jack R. Nicholas, Jr., P.E., CMRP, CRL, IAMC, BS, MBA, CAPT USNR (Ret)

"Great read for any reliability and maintenance leaders and practitioners who are looking to establish a reliability improvement program built on a first principles approach."

- David Blenkharn, Manager-Asset Management Excellence, Resources & Mining

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