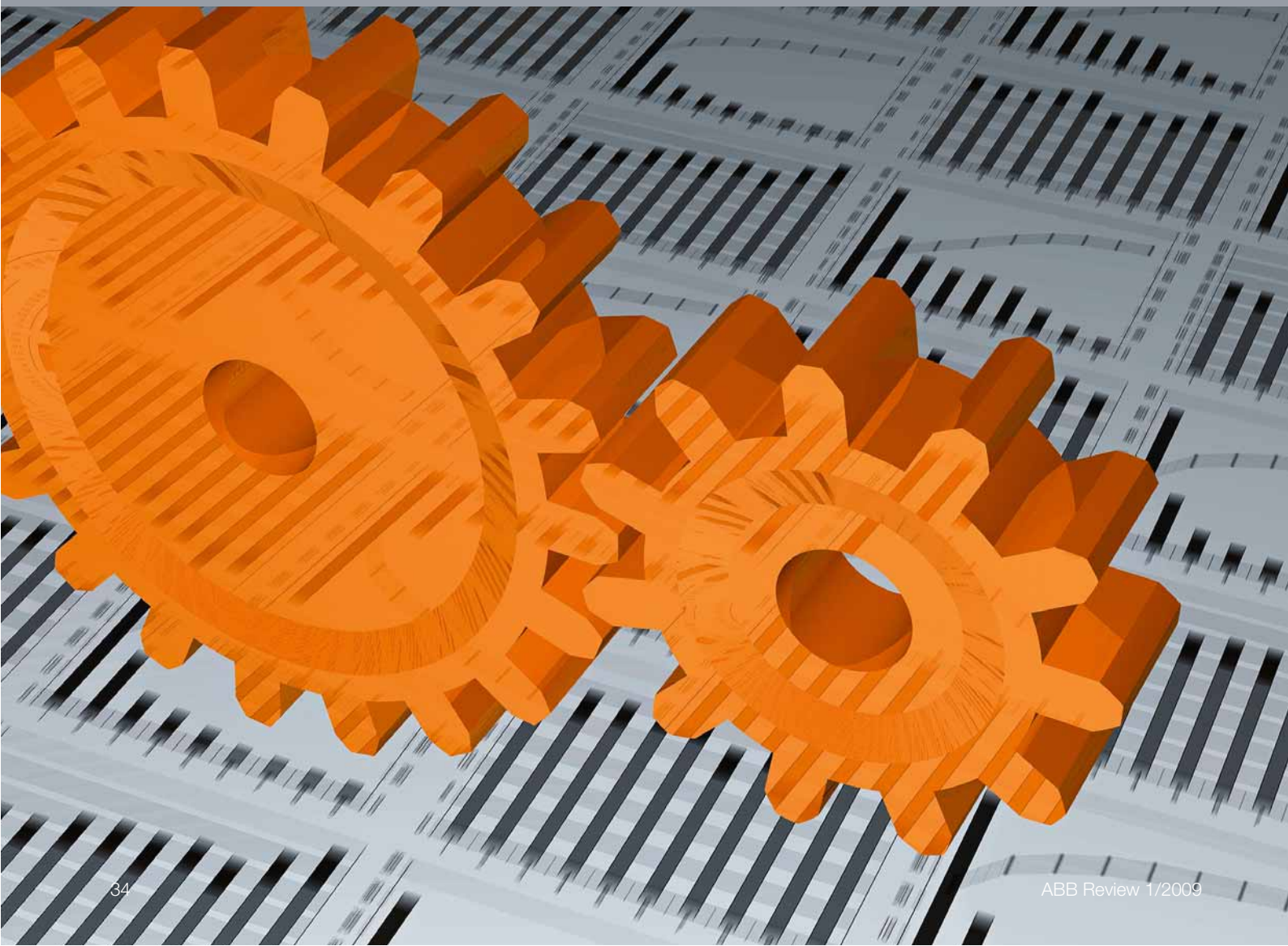
What is reliability?

Changing the reliability paradigm

Barry Kleine

Concepts used throughout the world to describe improvements to production throughput are often termed "reliability." But just what does the term really mean? What tasks that a plant's staff perform are considered "reliability" and how do these tasks actually improve the profitability of a company? Who, if anyone, should be involved in the reliability project?

If a plant decides to introduce a reliability plan, the actual steps agreed on are affected by the definitions used. One definition can lead the site in a totally different direction than another. It is therefore important to challenge and agree on the definition used. The absence of such a challenge may very well limit the potential of the improvements made.



This challenge is faced by ABB's manufacturing customers across the world. ABB is, however, also itself a manufacturer, and so often faces challenges and decisions similar to those of its customers. Within ABB, the refinement of these challenges has totally changed the direction the company's sites are taking – not only re-prioritizing what actions they take first, but aligning their sites through the adoption of common definitions to be able to better provide mutual support. The combined effects of these two principles have helped ABB achieve comfortable double-digit growth continuously over the last five years. In this article, *ABB Review* looks at some of the lessons learnt.

Paradigm 1:
Reliability means fewer breakdowns.

A common definition of reliability explains this in terms of equipment causing fewer breakdowns. Improving reliability is about having the ability to identify issues and repair equipment before the operations department notices anything is wrong. The operations department certainly appreciates the shift from unplanned stoppages to planned outages, but the maintenance actions thermselver still incur the cost of components and labor required to reinstate the equipment's functionality. There is therefore little overall benefit on the plant level. As a result of this definition, condition monitoring takes center stage, unplanned stoppages decrease, but frustratingly, maintenance costs and labor requirements changes little, if at all.

Further analysis of this situation shows that the equipment still needs to be replaced or repaired at the same frequency; so while production reliability does benefit, no practical equipment reliability has been achieved. Labor and material required for repairing the equipment stay largely unaffected, and any savings in reduced consequential damage is usually offset by in the additional inspections required. This shows that a more refined definition of reliability is required: one that not only includes reliability of production between shutdowns, but reliability of equipment – ie, less "need" for the shutdowns to fix the equipment. Maximizing the life of equipment not only means fewer breakdowns, but fewer required planned shutdowns, lower maintenance costs, lower labor requirements and lower required stores of spares.

In such a definition, the reliability concept should encompass actions that increment the current life being attained by the equipment (ie, actions such as lubrication, cleanliness, alignment, balancing, cleanliness) so increasing the mean time between failures (MTBF). It becomes apparent from this definition that actions such as condition monitoring are not related to reliability, but to the minimization of mean time to repair (MTTR).

New definition 1:
Reliability means less need for intervention.

Paradigm 2:
Reliability is used to determine equipment performance.

Site management teams are quite aware that equipment is not the only consideration for maintenance: Health and safety, environmental concerns, information management and planning and scheduling are just some of the other issues that need to be considered as part of normal business. When all the other aspects that need to be managed are taken into account in maintenance planning, it becomes apparent that reliability is not just the ability to maintain the functionality of equipment, but the requirement for all maintenance processes to function properly.

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Every time a process needs intervention from employees, cost is incurred. Labor is valuable, so a lower labor requirement in any of these processes is desirable and this is achieved by making the process more reliable. Reliability therefore advances from referring just to equipment to referring to the entire business.

When it is realized that a task taking ten minutes a day adds up to one working week per year, it becomes more important that intervention is measured instead of just production impact. Ten minutes of avoidable attention a day is one week lost per year, which that person could be using to address other issues.

An ABB plant in Kinleith, New Zealand, for example, realized that the two engineers in one department did not both need to attend the half-hour

morning production meeting. The decision to rotate attendance meant half an hour a day of the engineers' time, or three weeks a year, was freed up. A five minute decision addressing a non-equipment issue created a lot of time for the engineers to progress other activities.

New definition 2:
Reliability can be used to determine performance of all activities.

Paradigm 3:
Reliability practices belong to the plant floor.

It is traditionally believed that reliability tasks are the responsibility of engineers and trades people. This may be the case when the term reliability relates only to equipment, including the relating tasks such as alignment, lubrication, precision maintenance, etc. Plant managers do not see how those tasks relate to their level.

When the reasons that initiatives do not get implemented are studied, however, it becomes apparent that it is the management of the initiative that causes most of the problems. Insufficient communication about what engineers are doing or why they are doing it reduces the buy-in of the other employees. Not creating enough time or not checking the quality of tasks can affect how fast a task can be completed. These initiatives must be driven by the managers on the site to ensure the organization is delivering all the support that the team members require to implement their tasks properly. Without senior management support and involvement, reliability initiatives will struggle.

New definition 3:
Reliability practices belong to the boardroom

Implementation of a reliability program on a site affects all personnel and starts with the business needs – production volume, costs, employee satisfaction, etc. The issues affecting these objectives need to be understood and prioritized.

The ABB loss-mapping processes show more than 1,500 issues that can cause loss of profit on a typical site. Which variables, therefore, in all the site losses will result in the largest profitability improvement?

Supposing a gearbox failed last night and caused 10 hours of downtime – the temptation is of course to investigate it, but how does that failure, which occurs every six years, compare to the most frequent type of equipment failure on the same site – for example motors? The most common reason that rotating equipment fails is bearings, so how much loss results from bearings compared to a specific equipment type? A gap in the site-planning process may result in each job taking 10 minutes longer than required, so how does this loss – which results in less work being done – compare to the production and cost loss from bearings? How does communication loss compare to planning loss, and if this is an issue, what actions are currently underway to address it?

When there is no way to compare the losses for the above examples, or the site has not tried comparing them, confusion and disagreement set in. Different people will have different passions and the result is multiple initiatives clashing for the same limited resources and money. When this happens, progress in all initiatives slows down.

The most common reason that rotating equipment fails is bearings, so how much loss results from bearings?

Once reliability is adopted as a measure of overall business loss, it becomes a lot easier to get management support for reliability initiatives. This support is critical for project success. By raising the definition of reliability, it is then easy to see how the lack of reliability of equipment or processes then contributes to the different key performance indicators (KPI) – eg, overall equipment effectiveness (OEE) or cost.

One of the key issues is the difficulty in defining a reliability problem. The first question asked is typically, "what is causing the gap in OEE or cost?" The first-level answer to this is usually easy to see, eg, it may be that availability is the reason OEE is low. The lower and more detailed the level at which a response is required, however, the more difficult providing that response gets – due to lack of data. A site will most likely be able to de-

scribe the most obvious availability losses, but is the most frequent equipment-type failure known? People typically focus on what they know, which is normally equipment failures, while missing the major contributors to loss such as the notoriously unreliable communication. For every ten minutes per day of unnecessary or inefficient communication, one week per year of labor is lost. How much improvement has that cost on a given site?

Before anything gets addressed on a site, it generally becomes apparent that the documentation of loss is unreliable. Improving failure codes and understanding what is slowing people down will give a far greater understanding of where focus should be directed.

Successful sites

The most successful sites are the ones with a systematic approach to improvement:

Start with a business need

Key financial variables that affect the site should be identified – these are the ones that will make the largest difference to the profit margin. It is important to understand clearly, for example, whether maintenance cost that needs to be decreased, or in fast the maintenance cost per unit produced. Many examples are available showing a reduction in spending that led to a loss several times that amount in lower production due to decreased reliability. The site strategy needs to emphasize the few variables where the focus should be kept.

Improving reliability reduces both time and cost to repair.

Develop management support for the concept before it is started

Many processes are scheduled to be implemented on sites because other sites are doing it, or because someone believes they will add value. Unless the senior managers are sold on the fact that these processes are critical to achieving the objectives, little focus will be put on them and they will take many times longer than necessary to implement.

Excessive time to implement is a loss on a site as it means people are not available to work on other initiatives. It is for this reason that fewer initiatives should be implemented simultaneously, and the ones chosen should be the ones that the managers drive and show a personal interest in.

Establish how reliability can satisfy the business needs

As mentioned earlier, there is a distinct difference between reliability (reducing the need for intervention) and consequence minimization (fixing it faster). Many people are passionate about repairing, so focus can easily turn to these issues and reliability gets neglected. It is critical to understand that improving reliability reduces both time and cost to repair. Most other initiatives address only one or the other at a time.

It is generally accepted that interest in an initiative will halve if no improvement is seen within three months

Select reliability improvements based on their ability to deliver quantifiable business benefits

Many good reliability topics are chosen, but when a given task is selected, often little or no data is provided in terms of a business case or the return on investment predicted. Reliability initiatives are best focused on the most frequent issues, as these are the ones that will give the fastest evidence of improvement. Addressing an issue that only occurs every five years will need another five years to see any benefit.

Sustain momentum by publishing improvements

It is generally accepted that interest in an initiative will halve if no improvement is seen within three months. As the results are observed, these need to be published across the site to maintain commitment, not only by the team members but also by senior management. Lack of evidence will result in people looking for alternative initiatives before the current ones gain traction.

Maintain quality

If a process is agreed upon, it is important to then follow the process. When things get busy, there is a tendency to try and shortcut the process – the consequence is lower results, fewer published improvements and a drop in interest. It is important in this area that managers show interest in the quality of work to maintain the standard. People always get the behavior they accept.

Reliability is one topic whose implementation falters due to not having enough time. Time is created, however, by understanding that a lot of the current tasks are not getting as many results as the reliability initiatives can achieve, and that some of the reliability initiatives being pursued are focused on issues with too long a payback. Time can be created simply by reprioritizing with respect to the business needs.

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Further reading

Cinder A. (2008). Making reliability sustainable. *ABB Review Special Report Process Automation Services & Capabilities*, 54–57.